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**Action learning and primary teachers' pedagogical knowledge in
mathematics**

Doctor of Education

University of Sussex

2011

Declaration

This thesis whether in the same or different form has not been previously submitted to this
or any other University for a degree.

Signed _____

Date _____

Action learning and primary teachers' pedagogical knowledge in mathematics

Summary

In 2004 an inner city primary school, Hawksridge, found itself in the 99th percentile in mathematics and second to bottom nationally. Confronted with a plethora of local authority and National Strategy intensive programmes, which the school did not have the capacity to execute or sustain, Hawksridge's headteacher took the decision to turn to research to establish the school's future direction. The subsequent action research project, which used action learning as a dialogical tool, became the base of their rise from mathematical 'no-hopers' to 'influential institution' in 2010.

This case study focuses on Set One, the model that was created to experiment with action learning procedures, before it was refined and implemented in Hawksridge as Set Two. The purpose of Set One was to try and establish whether or not action learning procedures could develop teachers' knowledge and understanding of mathematics and in particular their subject, content and pedagogical knowledge. It is set in the context of a time when the government centralised what was to be taught in mathematics, how long for and the style in which it was to be delivered through the national curriculum and the national strategies. The 1999 national numeracy strategy was brought in to support the 1998 mathematics national curriculum. In 2001 a new mathematics curriculum was introduced and this is the version referred to in this work. The primary curriculum is in two Key Stages: Key Stage 1 is for children aged 5 – 7 and Key Stage 2 is for 7 – 11 year old children.

Set One, composed of four primary headteachers, their four mathematics' coordinators and four Hawksridge senior managers, met for one year to experiment with action learning procedures. It was capable of instigating a rich mathematical dialogue through its open-ended questioning and able to develop a collaborative, supportive culture where teachers demonstrated that they could be flexible in their thinking.

The three key features of action learning in Set One are the development of the skills of reflection, rich mathematical dialogue and collaboration. In the analysis of the transcripts from the sessions, these features are unpicked and scrutinised in detail from the social constructivist perspective. Different types of teacher knowledge are identified, in particular, the knowledge associated with the Mathematics National Curriculum and the National Numeracy Strategy and how teachers have integrated these two government documents as part of their knowledge base. An assessment of how teachers use this knowledge to ask and answer questions is undertaken. The power of open-ended questioning is explored and the growing expertise of Set One as a group evaluated, predominantly, their ability to listen, use silence effectively and to build up powerful stacks of questions capable of challenging teachers' mathematical thinking.

Action learning comes with caveats: it is not always a comfortable experience because dissonance is a part of the way it functions and for it to work well there must be trust, truthfulness and integrity. It is also a powerful managerial tool and should be used wisely to support and develop teachers' knowledge and skills.

Action learning procedures were implemented into Hawksridge before the termination of Set One. The lessons that have been learned have facilitated teacher development. Hawksridge staff are now capable of reflecting and learning from their daily experiences. Other benefits have been improved classroom practice, based on a probing dialogical questioning style which encourages pupils to think, improved collaboration across the school and a more careful and considered approach to professional development. Hawksridge has managed to find its way forward.

Acknowledgements

Writing a thesis is a preoccupying task and this research could not have been written without the assistance provided by many people.

First I thank my supervisor, Pat Drake for the quality of her supervision, and her belief that my work was of importance when my confidence wobbled.

Second, I thank my family for their fortitude when I mentally absented myself from weekends and family holidays. They will not miss piles of research papers and text books in their luggage. I would particularly like to thank my husband for his patience in checking my text for mistakes.

I acknowledge the valuable support of my local City Learning Centre, for helping me to download my tapes into a manageable format for transcription and their technological skills in untangling text and layout from two different computer systems.

My Deputy Head deserves special thanks for being my sounding board and encouraging me to keep going when work threatened to overwhelm me. Finally I thank my school staff and most particularly my senior management team who have supported me uncomplainingly in all of the action learning sessions. It is thanks to their commitment and professionalism that this research has been finally been written.

Glossary of Terms

AFL	Assessment for Learning
APP	Assessing Pupil Progress
CCK	Curriculum Content Knowledge
DFE	Department for Education
DCSF	Department for Children, Schools and Families
DoE	Department of Education
EAL	English as an Additional Language
FSM	Free School Meals
GCSE	General Certificate of Secondary Education
HMI	Her Majesty's Inspectorate
KCS	Knowledge of Content and Students
KCT	Knowledge of Content and Teachers
LA	Local Authority
MaST	Mathematics Specialised Training
QCA	Qualifications and Curriculum Authority
NCETM	National Centre for the Excellence in the Teaching of Mathematics
NNS	National Numeracy Strategy
NQT	Newly Qualified Teacher
OfSTED	Office for Standards in Education
PCK	Pedagogical Content Knowledge
PPA	Preparation, Planning and Assessment
RAISEonline	Reporting and Analysis for Improvement through School Self-Evaluation
SCK	Subject Content Knowledge
SEN	Special Educational Needs
SENCO	Special Educational Needs Coordinator

Action learning and primary teachers' pedagogical knowledge in mathematics

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Action learning and primary teachers' pedagogical knowledge in mathematics

Chapter 1 Introduction

1.1 The scope of the study

This case study, which is part of a wider action research project, began as a quest for answers to questions about poor mathematical performance at Hawksridge, an inner city primary school where I have been the headteacher since 2001. Throughout the last five years of study I have discovered that the answers to complex school problems are not to be found in textbooks, schemes of work, OfSTED inspection reports or national strategies because every school context is unique. I have learned that meaningful solutions draw on experience, old and new knowledge and educational research and whilst you can listen and learn from others you cannot transpose their identities, their beliefs and ethos into your own institution.

The decision to set up a mathematical action learning set for teachers and engage in collaborative learning arose from my reading on situated learning and activity theory, and how these theories can begin to explain and support the development of skills and knowledge in teachers. The process model that was developed had two phases or sets. Action Learning Set One comprised members from different schools, a cross-school model that experimented with action learning procedures. Action Learning Set Two was a more refined model that is currently in my school with the intention of developing teachers' mathematical skills, in context, in a collaborative setting. By process model, I mean the model of change as described by Kezar (2001) who describes a process model of cultural change that is aimed at specifically altering organisational culture. Briefly, the model (further developed by Burke, 2008) has four phases; pre-launch, launch, post launch and sustaining the change. The framework recognises factors that can influence change such as the external environment, leadership and resistance. It is useful because it offers an explanation for underlying cognitive processes which can affect organisational change. Set One fits into the pre-launch phase and Set Two in 'launch'.

The purpose of this research is to consider the effectiveness of action learning in developing collaborative mathematical practice and to see if it could professionally develop primary teachers' knowledge and understanding of mathematics, in particular, their subject, content and pedagogical knowledge. The first phase, the subject of this case study, developed Set One, which was set up in July 2008 to trial procedures, to experiment with ways of working with action learning. At this stage Hawksridge primary school was in recovery from a poor mathematical performance. It was still consolidating its staffing whilst trying to build a team of teachers that could raise standards and manage a diverse ethnic population in a deprived community.

Ethically, the school was not in a good place to be part of an experiment; it needed time and space to stabilise itself. Set One was therefore to be the model, which tested, trialled and investigated procedures. These would then transfer to Hawksridge in the hope of improving its mathematical performance. The plan was to trial action learning procedures for one year in Set One and then transfer the practice into Hawksridge; this would then become Set Two.

There was some overlap between Set One and Set Two: Set Two began just after Easter 2009 and Set One finished in July 2009. There was also some overlap between Set One and Set Two members. The senior management team from Hawksridge were all in Set One, learning the procedures and skills. By Easter, they maintained that they were confident enough to help set up Set Two. Set One members were interested headteachers and their primary mathematics coordinators from the local authority plus the senior management team from Hawksridge. Set Two was composed of all the teaching staff from Hawksridge primary school.

Whilst the contribution to this thesis is entirely from Set One, I am undoubtedly influenced in my analysis by what subsequently happened in Set Two and the success that the school achieved in mathematics in 2009 and 2010. The school's mathematical results rose from a dismal 25% at level 4 in 2004 (the second to bottom school in the country and at the 99th percentile) to 97% level 4 in 2009 and 100% in 2010. There were also significant numbers of children who achieved the higher level 5. More appreciably, children and teachers began to

enjoy teaching and learning mathematics. They were/are more confident and this greater level of expertise was enhanced by notice from the National Centre for the Excellence in the Teaching of Mathematics (NCETM).

1.2 Hawksridge Primary School

Hawksridge, the subject of the action research, is an inner city primary school in London set in challenging circumstances. It is currently ranked as the most deprived school in the local authority on the super output index. It has between 285 and 300 pupils although numbers fluctuate termly due to starter housing in the catchment area for asylum seekers and refugees. It is situated in an area of high-rise social housing wedged between considerably more affluent areas. Over 80% of Hawksridge's intake has English as an Additional Language (EAL), and there are currently over 36 languages spoken in the school. Many families arrive with children at varying ages, with little or no experience of education and from war-torn countries. The three largest ethnic groups in the school, Somali, Caribbean and White, are recognised as three of the poorest performing ethnic groups in London and the local authority.

Pupil mobility is not the only issue for Hawksridge. Over the past eight years, staff recruitment and retention has also been difficult resulting in a relatively young, inexperienced workforce and an untested senior management team. I joined Hawksridge in 2001 as headteacher after a period where they had been unable to recruit a headteacher for two years. I found significant underachievement, poor professional practice, high exclusion rates and entrenched attitudes about the capacity of the pupil population.

1.3 Good professional practice at school level

My notion of what constitutes good professional practice has changed over my 32 years of teaching, but it is what I hold now that is important to Hawksridge. This is because, as the headteacher, I am responsible for the style of delivery, our emphasis on the development of skills and the holistic approach, and I decide what content knowledge should be delivered. In

theory, since we have a national curriculum and a national strategy, this should not be the case but this is the way it is because the current curriculum is overloaded, overly prescriptive and ‘one size does not fit all’. I know that what I view as good professional practice may not be the same as other colleagues, and I also know that what counts as good professional practice at Hawksridge may not be the norm elsewhere. I have come to understand that there is no finite agreement and it is, I believe, context bound.

Since I began this research, professional practice at Hawksridge has changed. From 2002 to 2005 the school struggled to find its way forward. The priority became the recruitment of teachers who would stay at the school in order to begin to develop plans. Too often the school found itself having to ‘shore-up’ and repeat training as staff moved on, but by 2006 a nucleus of young staff was in place and it became possible to think more long term. These young teachers were resilient and could cope with change. It became possible to develop professional practice on a more stable basis and invest in individual development.

Mathematics lessons at Hawksridge now have two planning strands: teachers begin by thinking about the child and what they know and bring to the task, then they begin to deconstruct the concept they wish to teach. Hawksridge teachers are aware of the power of mathematical dialogue, and so they plan the key questions and the tasks they will ask the children to carry out to support the learning of the concept. We also know that to embed concepts we need to make sure that children can use the language of mathematics in a cross-curricular way; art, design technology, history and science are all specifically used at Hawksridge to support mathematical development. We have learned that good professional practice includes having conversations with each other about why children are struggling with mathematical ideas, and we share our knowledge and experiences not just in action learning sessions but often on a daily basis. It was not always like this, but this is where we are now on our learning journey and after 32 years in the field, I consider it to be good professional practice.

1.4 Rationale: a personal journey

To find yourself at the bottom of any educational pile and be publicly faced with your poor performance through the annual ritual of the league tables has to be one of the most extreme experiences for a school leader. It is humiliating, dispiriting and if you want to keep your self-respect, galvanising. There are two options available: resign, or deal with it. In 2004, my new school found itself in this position, with disastrous mathematics results (only 25% at Level 4). It was a time when the national strategy was deemed to provide support to all struggling schools: the three-part mathematics lesson, the pre-prepared lesson plans, the emphasis on pace, pitch and plenary, and national strategy consultants who were paid to deliver the strategy intensively via specially prepared programmes. But at Hawksridge it wasn't working and none of us knew why. Somewhere, somehow we had missed something; experience and old knowledge were suddenly insufficient. Initially we turned to the consultants but it became clear in the 2004 fallout, which resulted in too many local authority interventions at too fast a pace for us to assimilate, that we were going to have to help ourselves. We badly needed direction if we were going to improve.

The decision as a school leader to return to research was not a difficult one. We had tried not to hide behind our impoverished catchment area or blame too many government initiatives, but looked at how we might go forward and teach mathematics in a better way, and we asked ourselves many questions: how can we address this? What have we missed? For the first part of my doctorate (Phillips, 2007, *ibid.*) I was required to undertake a small-scale evaluation in summer 2007. The subsequent project evaluating mathematics in a London school with a similar, but more highly performing intake, helped to reflect on what was worth keeping and what needed to change. We learned:

- The importance of teachers working collaboratively;
- The significance of rich, well-informed teacher dialogue;
- The time and space to reflect upon issues;
- That teacher learning is best undertaken in situ if it is to be fully effective.

(Phillips, 2007)

These ideas became the basis of what I understood to be good professional practice. The next contributing work was a Critical Analytical Study (Phillips, 2008, *ibid.*). This provided me with an opportunity to view different perspectives on teaching and learning mathematics, and to revisit educational, psychological and social theory at a deeper level than in general teacher training. I began to understand that I was engaging in a complex, shifting-sand process. I didn't just need multiple perspectives, but multiple understandings of more than subject matter and pedagogy. Applying the ideas of Bourdieu (1977), Vygotsky (1986) and Habermas (1971) within my own field opened my eyes not only to opportunities but also to pitfalls.

Bourdieu's concept of *habitus* has been particularly helpful to me in understanding how it is that we know what to do. Habitus generates practices that are suited to particular circumstances, but it can also undergo change as a result of personal experiences and events. My own habitus has changed over the last five years arising out of my experiences of place and time within a changing institution. I hope that I have become a more thoughtful, reflective leader as a result of this work.

My reading on Foucault (1977) gave me insight into knowledge and the power of relationships and identities within a school community. This helped me to analyse what was going well at Hawksridge and where we might strengthen. It also allowed me the opportunity to consider how Foucault's (1977) five categories for the analysis of power relations might be applied to schools and education. The management of schools has become what Foucault would term a 'moral technology' or a technology of power. Foucault's disciplinary technologies (of which moral technology is one) describes a docile body which can be subjected, manipulated and subsequently transformed. Exploring Foucault's work allowed me to see that school managers (and I include myself in this category) attempt to manipulate staff into particular patterns of behaviour because the price of failure is, for example, loss of reputation, job or promotion.

Habermas's (1971) work appears to underpin a good deal of educational practitioner research. A central theme of his work advocates that teachers should adopt a critical stance to the language they use in their professional practice. He claims that certain styles of language are a reflection of the society that produces it and that it is this usage that generates and maintains the power relations and inequalities that exist in society. Habermas claims that language is the medium for reaching understanding and the means through which participants relate to the world. His theory of communicative action fundamentally indicates that people involved in argument are making a validity claim that can be accepted or contested. I have found his conditions for ideal discourse a useful benchmark for Set One. It has helped me to consider the role of language in greater depth, and begin to understand the value of dialogue as a means of teacher-to-teacher learning.

I have looked again at Vygotsky's work on the role of language in higher mental functions, and in particular the link between intellectual development and the social environment. This has been useful in analysing social activity as a means of learning within Set One.

I began to appreciate that I would need to create the right conditions for teachers to become learners; time and space to reflect are crucial if teachers are going to be able to see the 'big picture' and avoid the 'dead end' of teaching only to pass tests. The importance of dialogue in learning, both during lessons and between teachers, became more significant. This dialogue, I reasoned, needed to become richer, with improved subject knowledge, and a clearer understanding of pedagogy. Teachers needed to begin to work collaboratively so that informed dialogue could become a vehicle for school improvement.

Caution dictated the next moves. I did not wish to jeopardise the tentative moves forward the school had made by 2007 in retaining staff and beginning to build a team of teachers that could think outside the confines of the national strategies. Activity theory suggests that learning at work results in changes not only to the learners, but also to the nature of the work. I was interested not only in improving teachers' mathematical knowledge but also the process that might produce it. Meanwhile, four local headteachers knew of my interest in

research and asked if they could be a part of any studies undertaken in mathematics. This helped me to decide the way forward: I would set up a small group to explore methods of teaching and learning in mathematics. However, the embryonic group needed an operational purpose and my tutor, Pat Drake, suggested the approach of action learning. Briefly, action learning is learning through collaboration. An issue is presented to the group by one person and the group then proceed to question the presenter of the issue. Only open-ended questions may be asked. Action learning is explained in detail in Chapter 3.

The development of a mathematical action learning set, consisting of these local primary head teachers and their mathematics coordinators, as a means of developing the thinking skills and classroom practices of primary school teachers, was set up in July 2008. Creating and experimenting with a new way of thinking and learning which could then be used in Hawksridge was appealing. If the model that I intended to create would not work with a group of experienced senior managers, all with a vested interest in mathematics, then it might not work at Hawksridge.

Although the school was beginning to demonstrate the capacity to manage ‘change’, it was still in a precarious position with young, inexperienced teachers and an untried and untested senior management team. In addition, there would be more of an opportunity to test and refine the action learning procedures before asking my staff to undertake new work. *Figure 1.1* shows the early development factors that underpinned initial improvement at the school. It was not, however, until Easter 2009 that the preliminary trials for Set Two were established at Hawksridge

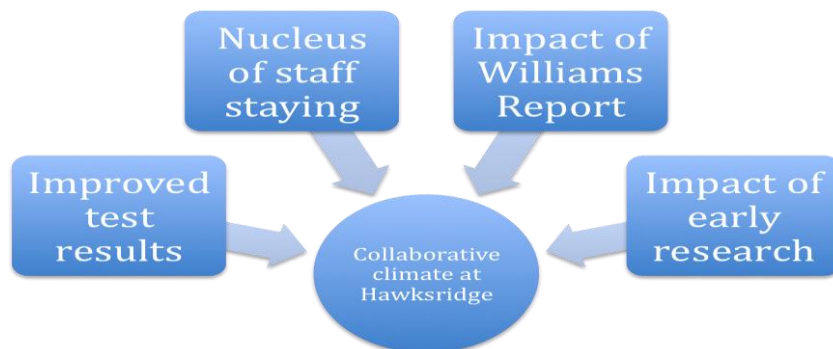


Figure 1.1: Early factors supporting the improvement of Hawksridge in 2007

1.5 Being a researcher and a practitioner

Undertaking action research within one's own practice may provide opportunities for personal growth as well as improvement in the practice. I have been the headteacher of Hawksridge school for the past ten years, and engaging in higher level studies for the last five has proved the most helpful in terms of my growing capacity to reflect and analyse my situation. Whilst many aspects of this experience are unique to the situation in which I find myself, and despite tensions along the way, I have come to see that examining experience from multiple perspectives is important for anyone researching their own practice. I have learned to look beyond the educational field with its tasks, tools, rules and values, and consider the political, social and cultural landscape in the community in which I work. I have also learned to re-examine my own identity, my way of being, thinking and operating and I know that I do not work in the same way as I did five years ago.

Reason (1994) notes that all knowing is from a perspective and that "critical subjectivity involves a self-reflexive attention to the ground on which one is standing" (p.327). It is also important to look at the way in which one stands on the ground and be aware of the different perspectives of those whom you would seek to support and guide, those to whom you owe responsibility and how they view you as a practitioner, leader and researcher.

One tension has been the issue of 'agenda'. The pressure to raise test results quickly and reach 'floor targets' set by the local authority has contrasted sharply with our quest for understanding. It has been a struggle for moral responsibility against quick fix government initiatives such as the intensive support programme. Other tensions have been more personal: it has been difficult to transform from normative practice where the focus is to produce valued outcomes to analytical mode where the focus is to produce valid explanations. I have also found significant tensions moving from the experiential to the theoretical mode. It has taken time to leave my old knowledge and experience behind, put it to bed as a 'trump card' in the staff room and use it as just one perspective in exploring practices of theory building.

Peters and Ragland's (2005) concept of 'levelizing' is a useful tool for analysing the 'stepping back' reflexive process. They outline four stages of development and so I have applied these four levels in considering action research in my own practice, primarily because I have professional responsibilities to my colleagues, pupils and parents and my actions affect their lives.

In the first stage, '*Pre-reflective, being in the world*' I found myself highly sensitised to my workplace position, the subject of unlooked-for attention from local authority consultants as a result of the poor mathematical performance of a Year Six cohort and the cumulative effect of too much poor quality teaching. In the second stage, '*Reflective Being*' in response to prompts from others (the beginnings of my evaluation research) I began to consider my actions in more depth and explore social theories that were new to me. In Level 3 '*Framing the Experience*' I began to be more aware of reflection on action, I listened to colleagues' and pupils' experiences in more depth. I tried (and continue to try) to listen with an openness to what was said rather than what I wanted to hear or what I expected them to say, and I tried not to take comments personally, become defensive or offer swift, surface advice. I recognise too, that I was not always successful in this. One way I found of negotiating criticism was to see it as coming from a different frame of reference (Peters & Ragland, 2005). To understand another's 'frame of reference' enabled me to seek some common ground and gave me time to think and reflect about what to say and how to support. These multiple perspectives or frames of reference that I am still constantly learning to examine can and do lead to productive dialogue, although I have often found it difficult to negotiate my way through this researcher-participant competing way of thinking. The tensions that I experience as leader/practitioner/researcher have led me to understand that I am unlikely to fix my educational dilemma, but I can at least more fully understand the nature of the problem, the context in which it arose and help others to see this too.

Through deeper engagement with social and conceptual theories, combined with knowledge gained as a result of the Critical Analytical Study, I feel I have now reached the fourth level, that of '*Theorizing*'. I begin to understand the importance of language and how it enables the

speaker to describe an experience. In action learning, it also requires that meaning has to be clarified to involved participants, and perhaps even for the speaker, to realise it for the first time during the conversation itself. I begin to understand how theories can shape our understanding of our world, although I feel a long way from constructing my own theories about learning in a particular context. It now seems clear to me that no single person, no matter at what level they are situated can positively impact on the workplace culture unless they engage at the level of practice.

I begin to see that workplace cultures are constructed by the people that inhabit them, and that the creation and sustenance of this social world requires highly developed linguistic tools. As Gergen (1999) notes:

“If we wish to change patterns of action, one significant means of doing so is through alternating the forms of discourse – the way events are described, explained or interpreted.” (p.115)

The perspective that I am adopting is that of the social constructivist because my reading and experience tell me that the most productive way forward is to engage in collaborative learning, a process that is founded in the shared construction of social reality and which I believe emphasises the joint construction of knowledge. Collaborative learning is characterised by four main elements: a dialogical space, a focus on construction, multiple ways of knowing, and cycles of action and reflection (Peters & Armstrong, 2002). A dialogical space has both physical and social dimensions; it is an environment where participants can suspend their own assumptions and practise focused listening in order to engage colleagues in such a way as to promote understanding. Action learning procedures fit this dialogical space very well. Its focus on construction allows participants to build on their own understanding and share their knowledge.

Whilst my ultimate intention was to create a community of practice, I now realise this was too ambitious within the time frame. Lave and Wenger’s work (1991) indicates that this type of situational learning is built up steadily through time, sometimes generations, and it is unrealistic to imagine that Set One, in such a short space of time, could fully meet this

criterion, nor could a school with high staffing mobility be correctly called a community of practice. Wenger (1998) also points out that a shared interest does not necessarily yield a community of practice and neither does shared practice. Although both of these contribute to some degree, it is how the group functions in terms of “domain, community and practice” (p.44) that ultimately defines it.

1.6 Dilemmas before ‘unfreezing’ at Hawksridge

I knew that experimentation would involve trying out new ideas, giving teaching staff the room to try new approaches and that I would need to look at professional training from a different perspective. However, I could not initially see how the model would drive forward improvement in the short term. Long term, I could see that as teaching staff improved their teaching skills then we might eventually raise our standards of performance in mathematics at Hawksridge.

Back in the classroom it remained difficult to understand why a child, groups of children or whole classes struggled with mathematics. Simply watching a teacher manage a class and teach a mathematics lesson was not enough to understand failure. Even more puzzling for a teacher was a child’s propensity to forget what had been taught. It was these questions that puzzled Hawksridge staff when they began to research why children were failing in mathematics. The action research project was designed to give us the time and space to reflect on these problems as a collaborative working group. I knew that it would not necessarily solve our problems, but, by developing our knowledge about what good mathematics teaching might look like and improving our understanding of the content of mathematics across the curriculum, it might help us to grow professionally as teachers. I also hoped that the creation of dedicated time and space would help us become more reflective. The goal that slowly evolved was to develop Hawksridge teachers within a reflective structure so that they could begin to develop their mathematical skills professionally, but before this could happen we needed a working model. An early dilemma was, ‘could Set One provide it?’

1.7 Building on earlier research

I had learned from my Critical Analytical Study that successful mathematics' teaching in the primary sector requires an understanding of subject knowledge, an appreciation of a child's mathematical reasoning, the meaning of mathematical ideas and procedures, and knowing how these ideas connect together. I had also begun to understand that knowing mathematics for teaching is different from knowing about mathematics as subject knowledge, and that it is how teachers hold these two types of knowledge that is important (Rowland et al., 2005). I resonated with this point of view quite strongly but it was going to be difficult to access this type of information from my day-to-day activities as headteacher – i.e. monitoring lessons – and it would be a lengthy procedure to hold individual meetings with staff. My early research had stressed the power of collaboration, improved dialogue and the requirement of time and space, and a report from the National Centre for the Excellence in the Teaching of Mathematics (NCETM) research team (Researching Effective CPD in Mathematics, 2009) confirmed my findings; highlighting collaboration through networking, the issue of time to focus on professional practice and the opportunity to reflect, but I could not initially envisage how this might happen in terms of professional development at Hawksridge.

Set One was designed to be an experimental community of inquiry. It was to be a tool for research into mathematical practice and I hoped that it would begin to allow access to the subject and pedagogical knowledge of teachers. How this would happen I was not quite sure, but the model fulfilled all of the early requirements that my earlier research findings suggested were needed. It was collaborative, it would give teachers dedicated time and space to reflect on issues they were struggling with, it was based on dialogue and, most importantly for Hawksridge, it had a purpose: all the mistakes should be made in the first model so that Hawksridge could develop the successful strategies in the second.

1.8 Relationships

There was more than one operational community in this research. I not only had to consider relationships in Set One but some of the members of this set were also part of my senior management team and I needed to consider my relationship in the new situation with them. I was also aware that this closeness to practice may have compromised my ability to engage critically with the data (Drake, 2011), and that I was in a privileged position since without their collaboration I would be unable to proceed. Ultimately, I recognise that this research is probably not replicable because of this advantaged position.

Additionally, I know that I have to live with the consequences of my research and, as the headteacher, I have a responsibility for the professional and emotional welfare of my staff. I have access to a great deal of information (i.e. from performance management) that has not been collected for the purpose of research and I cannot ‘not know’ this.

Essentially there are three groups in operation and interacting with each other. First there is the focused community (Set One) and its goals, tasks, tools, rules and values (which are probably different for each individual member), and then there is Set Two, the Hawksridge community, and finally my own community of practice; that of the insider researcher, also with my own tools, goals, tasks and rules and values. The meeting of these three is a challenge.

1.9 Summary and research questions

The initial action learning set, Set One, that I created was composed of five local primary schools, including my own, with headteachers and mathematics coordinators being the participants. Each member of the group came with their own identity, beliefs and purpose, and part of the challenge was the amalgamation, reconciliation and development of these beliefs and attitudes. All of the participants had registered concerns about underachievement in mathematics in their own schools and were becoming aware that the National Numeracy Strategy did not help teachers develop their professional knowledge. Of these schools three would be termed (in OfSTED parlance) as above average; nonetheless their headteachers had

registered concern about poor teacher knowledge and underperformance in all year groups except Year Six. It was not so much achievement in terms of test results and levels that the group was interested in, but rather how to become better at instruction through a shared understanding of how children learn mathematical concepts.

The main focus of this research was to consider the effectiveness of action learning in developing collaborative mathematical practice. For example, could it be used as a keystone in the development of mathematical knowledge? In the context of this proposed research, action learning needs to be seen as the process for a development project that Hawksridge hoped to undertake. I wanted, for example, to understand the characteristics and power of action learning in developing discussion, reflection and the sharing of mathematical knowledge. I intended to explore ways that action learning could be used to:

- Reflect on practice;
- Improve conceptual and procedural understanding;
- Engage in reflective dialogue with the purpose of enabling connective learning.

The six mathematical issues, outlined in *Table 1.1*, that the group pursued in their meetings arose from their day-to-day practice: five of the issues were presented by teachers and one by a headteacher. Hawksridge senior managers presented two of the issues.

Specifically, my research questions are:

1. Can action learning extend and develop teacher knowledge?
2. In what ways does action learning enable teachers to draw on their expertise and skill?
3. Does action learning facilitate teachers' development of pedagogy at different points of professional development?

I anticipated that headteachers and coordinators of individual schools would eventually take charge of the development of practice in their own schools, forming second sets, then becoming managers of their own mathematical programmes, but this was outside the scope of this particular study.

Table 1.1: The six action learning session issues for Set One

Purpose of meeting	Does debrief indicate any changes for presenter of issue?
I have been trying to teach my class how to tell the time and after three weeks they still have no idea, so how do I help children tell the time?	Re-wrote plans for term and started theme again
What are the stages in moving towards the teaching of long division?	Re-assured presenter that she was thinking along 'right lines' Made use of action learning style questions as a manager.
My children do not understand multiples	Abandoned NNS and re-wrote plans. Visited KS1 to find out how early patterning was taught.
The children in my class can subtract but they do not understand 'find the difference'	Looked at use of mathematical language in everyday situations.
Two of my colleagues persistently teach weak mathematics lessons	Re-looked at purpose of planning in lessons. Re-thought teacher organisation with head.
How can I help my staff to understand the mathematical lines of development?	Encouraged own staff to work in teams. Encouraged staff to question NNS and what should be taught and when.

1.10 Structure of the research

In Chapter 1, I described the origins of Set One and the stimulus for the action research. I explored my own position as an insider researcher before setting out my research questions. In Chapter 2, I review the action research field and separate action learning into process and skills with particular regard to mathematics education. I look at different types of mathematical knowledge that effective teachers use and how this affects institutional and individual practice. I argue that, because of the diversity of individual needs, mathematics training is best carried out in situ rather than the current model of the 'one-size-fits-all' national strategy model.

In Chapter 3, I explore my theoretical position, the design of the research and the process of collecting and analysing data. I argue that theory provides an essential base for action research and that without this foundation it is difficult to establish success.

In Chapter 4, I begin to address my research questions, exploring the work of the Set One teachers and the various ways in which they draw on a range of knowledge and skills. I begin to devise categories of questions, recognising that, sometimes, simple classifications are inappropriate. I make a distinction between national curriculum and national strategy knowledge because I discovered that teachers hold and use this knowledge in different ways. Importantly, I begin to understand that I must locate my work in both theory and the world of professional practice if I am to make sense of my transcriptions.

In Chapter 5, I draw upon the first analysis in Chapter 4 and look in greater depth at the knowledge and skills required to ask open-ended questions in sequences. I argue that it is either the sequential aspect and/or the collaborative aspect of action learning that enables participants to reflect in depth on their work. I also claim that without this kind of open, reflective process much teacher knowledge remains tacit, since it is difficult to reflect at this depth by oneself.

In Chapter 6, I locate the work of Set One deeper within theory. My research shows that theory is an essential part of action research because it provides a framework for analysis and reflection and it allows the researcher to engage with the data at a more abstract level. In the final chapter (Chapter 7) I return to my original research questions, assessing what I have learned, what the set members have learned and the implications for future practice. I look at the contribution this piece of research has made to the field, what it affirms, what it probes and what questions it leaves unanswered.

Chapter Two

Review of the field

In this chapter I first look at the origins of action learning and its place in mathematics education. I then go on to explore the significance of questioning as a way of learning primarily because questioning is a key element of action learning and I link this to reflective practice. I look at the importance of developing mathematical discourse and more specifically what can be gained from applying activity theory to the field of action learning. I argue that because teacher-training needs are very wide, the best kind of training is that which is carried out in situ and in response to the needs of individuals and institutions. I look at the different types of mathematical knowledge that teachers carry with them and how this can affect institutional and individual practice. Finally, I look at recent research into the different types of knowledge that teachers hold and consider how action learning might have a possible place in the professional development of teachers.

2.1 How the 'Critical Analytical Study' informed this research

In my Critical Analytical Study I investigated the sociological, psychological and cultural approaches that have informed mathematical policy and practice. I drew on social theory to explain why throughout their careers teachers are engaged in creating and recreating themselves as they develop their professional identity, before considering learning theory and teachers' knowledge of it. Using case studies from my own school I explored learning theory and the mathematics classroom. Finally, I looked at situated learning and the development of communities of learners. It was this area that interested me most of all in the light of my reading and writing. I came to the tentative conclusion that if teachers at Hawksridge were going to improve their practice, then it must be in-situ. Grandiose government programmes by themselves do not meet individual needs and large local authority meetings do not allow the development of the language of mathematics, which primary teachers so badly need to share and develop. Most of all, I learned that schools

reflect their communities and so it made sense to develop my own school community as its own resource base.

2.2 The principles of action learning

Action learning is a process that involves learning through collaboration. It can be summarised as group learning with an emphasis on dialogue through reflection *on* action and reflection *in* action (Schön, 1987) using Socratic questioning techniques. It is not coaching as described by school leadership documentation (National College of School Leadership, 2006) because it differs in significant ways:

- It is group collaboration.
- It is focused on open-ended questioning.
- It is focused on the presenter reaching a resolution as opposed to the giving of advice.
- It is a dialogue rather than a discussion because group members build it up individually.
- It sees learning as a social and interactive experience where knowledge is constructed through reflection on practice.

Action learning is explained in detail in Chapter 3. Briefly, it offers an opportunity for someone acting as ‘a presenter’ to offer a mathematical issue to a safe group. Rules are agreed whereby the presenter is protected from direct advice from other members of the group but is questioned about the issue in such a way that the presenter retains ownership of the issue.

2.3 Socratic questioning

The use of questions and strategies for questioning in action learning are based on Plato’s depiction of Socrates interrogation of a young slave. He enabled the boy who had no prior knowledge of mathematics to solve a geometric problem by restatement and asking him open questions. Socrates’ further interrogation of the slave’s owner, Meno, illustrates that through a process of question and answer problems may be resolved. Meno does not know as much as he thinks and he is forced to reflect and discuss his beliefs with Socrates. For example,

Meno is initially certain that he knows what ‘virtue’ is and it is only under Socrates’s questioning that he recognises that he has no understanding of this topic. The dialogue does not in itself reveal new knowledge but it indicates where the search should take place and it encourages Meno to follow this course of inquiry.

The ‘Socratic method’ was originally developed by the German philosopher Nelson in the 1920s and mathematics was his model (Saran & Neisser, 2004; Mitchell, 2006). He transformed it from discussion between two participants to group dialogue. The possibilities for developing Socratic dialogue in learning were also developed by Heckmann (1987), who used it with higher education students and began to specify some prerequisites: i.e. the non-participatory role of the facilitator and the kinds of issues that could be considered.

In action learning, Socratic questions are always open-ended; they cannot be answered with one or two word responses. ‘Leading questions’ are avoided or rephrased (unlike Socrates’ quizzing of Meno’s slave). Questions are phrased in such a way that the presenter of an issue is meant to be able to reflect on and evaluate action taken. Dialogue is built up between the set members as a result of this Socratic questioning and careful listening.

2.4 Action learning as an educational tool

Action learning was also developed by Revans (1982) as an educational tool for learning. Revans saw action learning as significantly different from transmission teaching and from learning which he believed had an emphasis on knowledge acquisition because of its stress on context and collaboration. In the Revans model, action learning recognises that development is related to a social and emotional context and that learning is a social activity. It recognises where people are in their learning process, values their experiences and acknowledges how that experience has been utilised in their current lives. It also values the right of individuals to learn and assimilate at their own pace. This is in contrast to many of the classrooms today where learning is often conducted in isolation and in a competitive frame.

Raelin (2006) best summarises the process by describing the information and skills that the participants already possess in an action learning set as ‘P’ (programmed instruction) and the Socratic questioning as ‘Q’. Raelin considers Q to be the component that produces the most behavioural change since it results from reflection on experience. Wenger’s (1998) contention that we create ways of learning in practice in the very process of contributing to it, thus making that practice what it is, accords well with action learning procedures.

2.5 Questioning skills

In 1993 I wrote my Masters dissertation (Phillips, 1993) on the skill of questioning: ‘Does asking higher order questions result in higher order thinking?’ At the time I was undecided; although I found that if one did not ask higher order questions at all, then the chances of higher order thinking were fairly negligible. I now know that what the respondents bring to the situation and the context has a great deal more to do with this than I originally supposed. In any catalogue of teacher skills, questioning has a high priority and particularly the importance of asking open-ended questions. Most teachers find this difficult (Brown & Wragg, 1993).

Productive teacher questioning serves to scaffold and advance children’s mathematical thinking. It helps them express their ideas in a mathematical way, helps them to make connections with prior thinking and can serve as a framework or structure for a problem or an issue (Brown & Wragg, 1993). Teachers need to ask more than just low-level questions of recall if children are to learn effectively. Useful types of question in a mathematics lessons are those that ask for:

- Description – asking children to describe their work.
- Challenge – by inviting children to explore further.
- Connections – asking children to make links with prior learning.
- Probing – asking children to justify their reasoning.
- Redirection – asking for clarification of the ideas of another child.

(Williams, S. 2009)

By asking good questions, teachers can facilitate conceptual development but in the hurly-burly of the everyday life of the classroom, it is sometimes difficult to put this theory into

practise. Action learning gives teachers the opportunity to practise these skills amongst peers and is a reminder of the power of good questioning.

2.6 Effective teaching and teachers

The question of what makes an effective teacher has no clear answer because each teacher brings to the task their own particular traits and characteristics as well as learned behaviours. Moreover, personal experience tells me that what is effective in one school may not be effective in another, so it becomes context bound. Cruickshank *et al.* (2003) define the effective teacher as one that is:

“caring, supportive, concerned about the welfare of their students, knowledgeable about the subject matter, able to get along with others ... and [be] genuinely excited about the work that they do.” (p.329)

Some of the characteristics of effective teachers occur repeatedly in the research (Steele, 2010) and of these the ability to communicate effectively verbally and non- verbally, teacher self-efficacy and strong leadership ability are thought to be essential requisites for helping children learn.

Of these three characteristics I was particularly interested in verbal and non-verbal communication and self-efficacy as elements that might impact on the performance of action learning set members. I discovered that it is only quite recently that the power of non-verbal communication has been recognised (something that successful managers have known for some time but possibly never articulated). I made use of the information on non-verbal communication in a different kind of way; it guided my research diary entries when studying the set members during sessions. Learning to look for body movements, eye control, facial expressions, the tone of voice, its pitch, volume and rhythm and the rate of speech allowed me insights that I might otherwise not have recognised. My research diary was richer with this knowledge.

I was also attracted by the notion of improving teacher efficacy and the fact that it can be achieved through social persuasion. Teachers with high self-efficacy are often the most

effective (Woolfolk *et al.*, 1990). It is known that they can influence classroom behaviours by, for example, the amount of time that they put into planning lessons, their organisation, their ability to set goals and their willingness to experiment with methods (Bandura, 1977 cited in Steele, 2010). I reasoned that if action learning could be used as a tool for social persuasion, i.e. improving pedagogical skills in a particular way, then the chances of the Hawksridge staff in Set One absorbing these and developing higher self-efficacy would be greater. High self-efficacy is also thought to be one of the reasons why teachers will persist with pupils who have greater learning needs and at Hawksridge we have a higher than average proportion who have special needs in terms of behaviour, learning difficulties and second language. I concluded that there was little to lose in trying to improve teacher's self-efficacy through action learning and everything to gain.

2.7 Tacit knowledge

Raelin (2007) contends that action-learning techniques address tacit knowledge and bring it to the surface of learning. He defines tacit knowledge as:

“not typically reportable, since it is deeply rooted in action and involvement in a specific context [and] although not necessarily mediated by conscious knowledge... it may serve as the base for conscious operations.” (p.500)

Tacit knowledge is interesting and merits further attention because it is often bound to personal identity. Indeed there is compelling evidence to suggest that teachers' experiences as learners of mathematics, their conceptions about the nature of mathematics and their practice as primary practitioners are closely linked to their beliefs about mathematics (Askew *et al.*, 2001; Macnab & Payne, 2003; Brown & McNamara, 2005; Wilkins, 2008). Meanwhile research into primary mathematics teachers' beliefs suggest that these 'beliefs' act as their own theories into how children learn (Richardson, 1996, cited in Lavy & Shriki, 2008)).

Strong evidence indicates that teachers' professional identities and their beliefs take shape as their lives unfold. They are not fixed but continue to grow and change (Nias, 1989). Teachers' identities are likely to be multifaceted, deriving from their personal and social

experiences, whilst beliefs may set boundaries around what they see and how they interpret classroom experiences. Some of this may be linked to tacit knowledge. There is some disagreement whether beliefs are the result of practice, the main influence on it or an integration of the two (Hoyles, 1992, cited in Skott, 2001). In action learning, set members draw on a mixture of personal experiences and knowledge to reflect on their work. It is impossible to tell whether this knowledge is tacit or not, but one should not discard the possibility that it carries some influence in teachers' solutions to classroom problems.

2.8 The importance of dialogue in any kind of learning

Recent research indicates that the most effective teachers are those who are skilled in promoting discursive contexts over a sustained period of time (Boaler, 2009). Promoting creative mathematical discourse, however, is complex. It demands new pedagogic skills, alongside confidence in subject, curricular and content matter and it is but one variable in a raft of many. Most educational research in this area is influenced by Vygotsky's theory of thinking and learning. His social constructivist theory places a strong emphasis on the co-construction of knowledge, with more experienced learners collaborating with less experienced on activities. In place of competition and individualism, his approach proposes collaboration and engagement in dialogic inquiry.

More talk in classrooms does not necessarily improve pupils' mathematical learning. It has to be a particular kind of talk. Just keeping the conversation going does not necessarily move children's thinking forward (Doyle & Carter, 1984; Khisty & Chval, 2002). Studies of effective practice (Askew *et al.*, 1997; Adhami *et al.*, 1998) indicate four main linguistic areas that teachers need to engage in for optimum pupil learning. First, pupils need the *opportunity* to participate in mathematical dialogue. Second, the dialogue should require children to explain their thinking and *begin to articulate* their ideas. Third, *teachers need to be able to fine-tune mathematical language* as children move from the generalised to the specialised language of mathematics and fourth, they need to be able to *shape mathematical argumentation* (Walshaw & Anthony, 2008).

This development of dialogue in mathematical knowledge is dependent upon teachers spotting the golden moments in conversation and makes new demands on their classroom skills. Not only do they require good curricular knowledge, good subject knowledge and well-developed pedagogical skills but they also require the ability to manage multiple viewpoints, flexibility and the ability to reflect on the spot. Paying attention to the language in use and learning how to use mathematical language and to share ideas and methods are, it seems to me, the connection points between teaching and learning.

Burbules (2006) identifies four types of dialogue (inquiry, conversation, instruction and debate) that are useful in two ways: first, when planning a classroom inquiry and second, when analysing transcripts of conversation. Of these, inquiry should be the one theoretically most evident in an action learning set, although this does not exclude the other elements. Burbules also notes that there are other dialogic forms – for example, analytic – which could be added to the list. Buber (1961) judges that a genuine dialogue should be an exchange of ideas and meanings that develop and promote awareness of thought and values. In a genuine dialogue, no one is trying to score points or win. Important elements in this concept of dialogue are the skills of listening and understanding.

Teachers play an important role in facilitating classroom dialogue. Their particular style of teaching can influence the amount and quality of dialogue and attitudes of pupils to sharing and discussing mathematical knowledge. Action learning offers teachers an opportunity to practise their critical dialogic skills. At its strongest point it can be meditative with individuals examining their own or others' perspectives with possible transformation. At its weakest point, it could simply mean description without reflection.

2.9 The under-rated skill of listening

In order for a set to function effectively, set members have to listen carefully to each other. Real listening is not as easy as it sounds. Maslow, (1969), (cited in Brockbank & McGill, 2004) comments:

“to be able to really listen ... really wholly, passively, self effacingly listen without presupposing, classifying, improving, controverting, evaluating, approving or disapproving, without dueling with what is said, without rehearsing the abuttal in advance ... such listening is rare.” (p.96)

Yet despite being central to the practice of learning, listening is a neglected element in education, as most social learning approaches seem to privilege speech over listening (Wenger, 1998). By contrast, philosophers such as Levin (1989) point to the potential of listening in discursive practice. Listening, he suggests, is an initial form of answering and therefore a condition of learning. Jacobs and Coghlan (2005) in their study of management strategies highlight how weak listening skills can impact on opportunities to learn. They identify four areas of interest to this research:

- Listening as constituting relations (i.e. respect from all parties/neglect).
- Listening as constructing meaning (its potential to generate meaning).
- Listening as competent participation (constructive exchange of ideas).
- Listening as identity formation (developing a sense of coherence and belonging within the community).

Jacobs and Coghlan (2005) maintain that a lack of ‘listening’ impacts on people’s ability to become competent members of their community and thus impedes opportunities to learn.

2.10 Silence

The desire for dialogue, however, can carry its own type of influence, since some members of a community may opt to be silent. In action learning, participants may choose to remain silent to create a space for others to speak or they may choose to remain silent because they do not wish to explain themselves. Thus silence can be active or passive it can be voluntary or the result of external pressure. Silence can also be situational, or it can be the result of attentive, thoughtful listening. To judge silence as ‘weak or strong’ (Lees, 2009, p.15) underestimates the power of silence. Le Carré (2008) usefully defines different types of silence:

“There are eloquent silences, and guilty silences, and silences of genuine bewilderment, and silences of creativity. The trick is to know what kind of silence you are hearing...” (p.143-144 e-reader)

For a facilitator (and an observer) in an action learning set, silence is unnerving because one cannot be sure what type of silence it is. It is not an empty space; it may be filled with uncertainty, trepidation, deep thought, contemplation and avoidance. Even a silent person can be said to be influencing a group if the silence can plausibly be taken by others to be acquiescence. My research diary noted that long silences were uncomfortable and body language and facial expressions indicated that set members seemed to find them as uncomfortable as I did.

2.11 The reflective practitioner

The ability to reflect *on* practice, whilst *in* practice is a key feature of action learning. Schön's (1987) work on how professionals develop their knowledge/theory into knowledge plus experience, demonstrates how teachers can survive in uncertain and unanticipated teaching situations for which answers are not to be found in a textbook. Schön describes this as reflective practice on emergent practice and this reflection becomes a part of an individual's knowledge as the practice develops. He terms it 'reflection-in-action' as opposed to 'reflection-on-action', the latter referring to the act of reflection after the action has taken place. Schön sees this as a constructionist view of reality because the practitioner's view of reality is rooted in their own perceptions and beliefs. Eraut (1995) argues that Schön seriously weakens his argument by overgeneralising and overextending it. He points out that to reflect 'in-action' is not a new kind of knowledge but a process of knowledge creation. He also maintains that Schön neglects two crucial aspects which are a feature of teachers' everyday lives: first, the context in which they find themselves and second, in the hurly-burly of the classroom, finding time to reflect. Eraut (1995) notes that teaching is an "excellent example of a profession process shaped by the necessity to work near the rapid end of the continuum" (p.18). Eraut usefully adds a third distinction to Schön's reflection-in-action and reflection-on-action, that of '*reflection-for-action*'. He claims this added preposition indicates the purpose of any reflection.

Schön views the ability to reflect-on-action as key to professional development, although he acknowledges that a skilled practitioner may not be always skilled in articulating what has

occurred. Brockbank & McGill (2004) concur with this and in addition maintain that reflection-on-action in dialogue with others is more likely to promote critical reflective learning than if left to the individual. Eraut's (1995) view is that in addition to these factors the ability to reflect is related to time, disposition and the 'post qualification routinization of professional work' (p.18).

Bolton (2005) calls this process of self-reflection the 'through the looking glass' approach (p.67) because when Alice went through the mirror, she learned that familiar things and situations could not be taken for granted. In action learning Set One, presenters consciously stepped through the mirror and their 'taken for granted' beliefs were revealed to the set. The situation was magnified because they were exposing their practice to others who may have had more or less experience than themselves. This was a high-risk strategy for all involved. Set members were entering new territory, exposing their knowledge and skill levels to a new audience.

2.12 Activity theory and action learning

It is possible to think of Set One as a series of evolving discourses within a systems network in which the participants were equally constituted through their interactions. This idea of a close relationship between social processes and conceptual development is fundamental to Lave and Wenger's (1991) social practice theory. In this respect, Set One's central feature of attempting to develop 'collective knowing', where individual and collective knowledge merged and emerged, was dependent upon the quality of space the participants shared in meetings. Positioning myself from a social constructivist stance allowed me to see that this 'collective knowledge' was in a constant state of revision each time the group met and that it was produced through social interaction. Engeström (2001) provides an explanation of community through his activity system. His theory is able to deal with communal settings such as

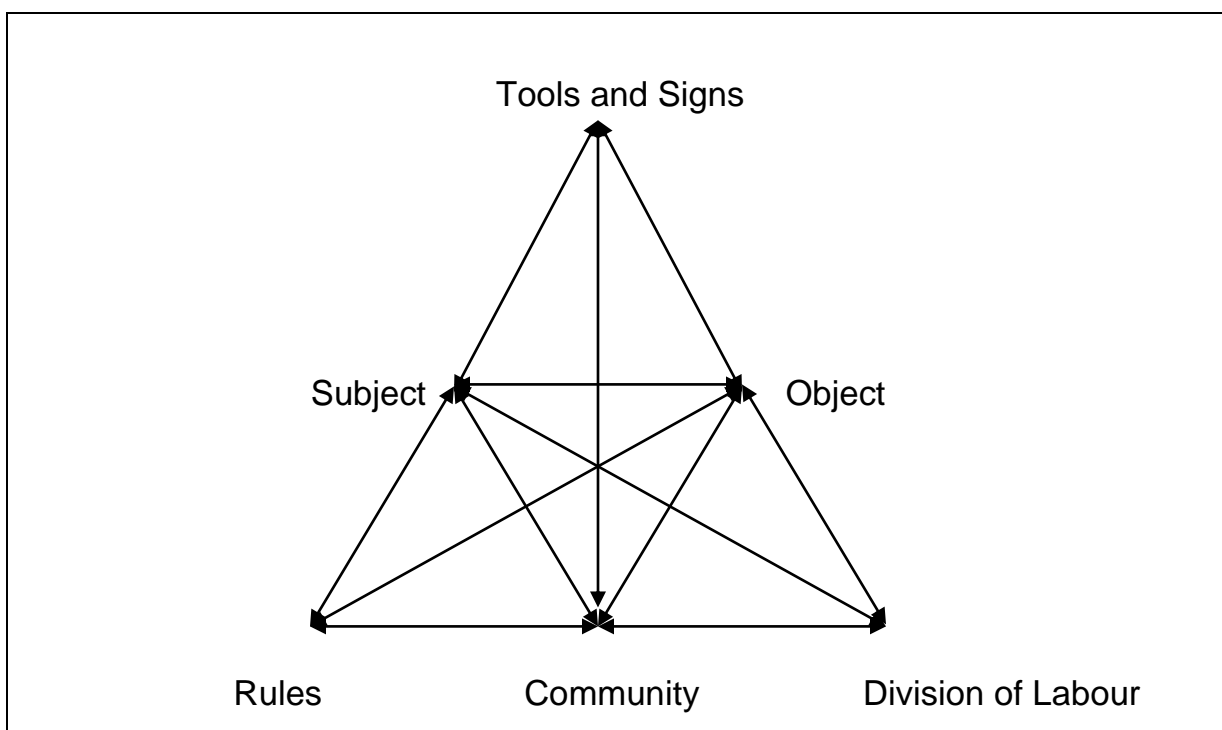


Figure 2.1: Engeström's Cultural/Historical Activity Theory

Set One, which was driven by common motives but probably different goals and by constant movement and outside influences that impacted on Set One's individual and collective knowledge.

Figure 2.1 shows Engeström's model of the human activity system. It is useful for understanding how a wide range of factors work together to impact on an activity. In order to reach an outcome it is necessary to produce certain 'objects': in this case the mathematical and pedagogical experiences of the Set One participants and their mathematical knowledge.

In the system, artifacts mediate human activity; here, the main tool used was dialogical skills. Activity was also mediated by the action learning community and the operational rules that affected sessions. Set One participants, worked as part of the community to achieve the object, which in action learning terms, was to try and help the presenter resolve their issue.

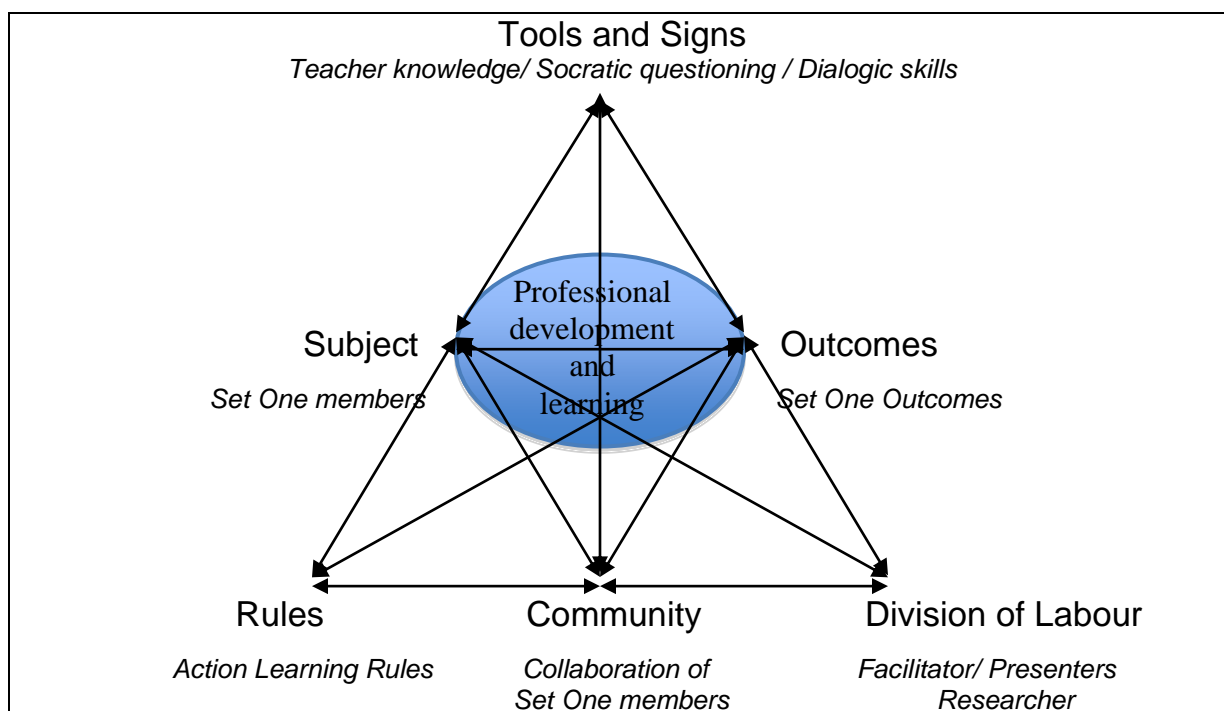


Figure 2.2: Linking activity theory to action learning

For myself, as the researcher, it was the hope of improved knowledge for set members. Three levels operated within the activity system and these were distinguishable in the action learning set. First, there was the activity towards an objective carried out by the community (which may have been different for each member of the community); second, there was the action towards a particular goal, which could be carried out by an individual or a group. (The presentation of a mathematical issue and the impact of self-reflection for the presenter.) Third, there was the actual operation itself, the process of engaging in open-ended questioning, reflection in action and reflection on action.

Drawing on the major ideas outlined above, the human activity system model as it applies to an action learning set might possibly be summarised as in Figure 2.2.

The outcomes for the Set One members (as interpreted by the researcher) were improved mathematical understanding and new, improved practices. Professional development and learning occurred in the centre of the system.

In effect, Engeström shows us that academic outcomes are the result of a complex web of relationships around which knowledge production and the exchange of knowledge revolve. This means that the processes that operate at the macro level of the educational system, involving government policy and school contextual policies, create a context for the work that teachers do at the micro level of the classroom. Teaching, then, might be seen as a joint enterprise based on knowledge and professional support systems. Without high quality professional development in schools and a mathematical understanding of how children learn, the opportunity to develop mathematical understanding across the age ranges, may well limit teachers' professional development.

2.13 Group dynamics in action learning

Set One is not a natural group; it is an experimental group with roles and structure imposed by context. Its activities fit the characteristics of the 'Laboratory Method', (Luft, 1963) which is particularly relevant for the study of groups in action. When a group assembles for a particular purpose, the members primarily concern themselves with content (Whitaker, 1985). Such a group requires structure, although this structure may change as the group moves through the different stages of development. It is also important to recognise that the number of participants, their motivation, their skills and resources, as well as the physical and social environment, can impact on the ability of the group to operate efficiently. Variables such as the nature of the task, composition of membership, the amount of available time, motivational forces from inside and outside the group, intergroup pressures such as levels of trust and issues of power need to be taken into account when studying groups.

I now understand that a group is a living system because of its shared perceptions and interactions; it has feedback systems through member interchanges and when working productively an ability to 'sense' what is happening. A group such as Set One is also an environment where new behaviours can be tried out and rehearsed and where participants can learn to work together to produce solutions.

Researching and understanding how groups develop and the interpersonal skills that set members need has been a useful exercise. Much of the knowledge I have acquired has been used to develop Set One, Set Two and more recently Set Three. This newest group is composed of three further schools in the local authority that have heard of action learning and want to understand how it works and learn the skills themselves.

2.14 Knowledge for teaching mathematics

Current thinking relating to the search for desirable outcomes suggests that there are many powerful examples of what works well in classrooms, in particular settings. By desirable outcomes, I do not mean high-test results as defined by the league tables at the end of key stages one and two. I mean the search for understanding about what constitutes the effective development of mathematical skills and knowledge in children.

As a headteacher I am required to consider formally the ‘impact’ of my educational actions on a termly basis. The reality is that I probably consider ‘impact’ daily, constantly assessing the outcomes of my actions on teachers and their children; but I have learned over these last five years to give my teachers space. The ‘impact’ of this action has been that we have made mistakes but we have created a culture at Hawksridge where mistakes are acceptable. It is better to make a mistake, reflect with colleagues and work to put it right rather than to carry on in ignorance. In this way we move forward, continually exploring what is right for our changing pupil population and ourselves as teachers. ‘Impact’ at Hawksridge means to have an effect, to carry out an action that may cause change although I acknowledge that impact and change can occur over different timescales and they are not always easy to recognise. Self-reflection and communication have become key features of our way of working. In this way, one begins to develop multi-perspectives and stay in a constant state of revision. This is not a comfortable way of being but by engaging and challenging each other we have steadily transformed the way we work.

The other words we use too prolifically are ‘good practice’. Back in 2004 at the outset of my educational dilemma, I wanted to know what good practice in mathematics should look like.

‘Good practice’ is a much-used phrase and can mean diverse things in a variety of contexts and to a variety of people: it is used by different professional groups to mean numerous things. For example, OfSTED have a ‘good practice’ database, and have released a ‘best practice’ report on getting the best results. This version of ‘good practice’ is related to high achievement in terms of tests results. Another professional body, the NCETM, defines good practice in a distinct way. They considerate it to be the act of teaching, (and this in itself opens up another myriad of ideas because this can refer to different sorts of teaching) and also the making of teachers: how they act, behave and manage their work. At Hawksridge, when we use the word ‘good practice’ we are usually referring to the act of teaching, which comprises clear communication between teacher and child, relevant subject knowledge, appropriate content and skills that are to be taught and knowledge of what the child brings to the lesson. This can include not just knowledge and skills but their emotional well-being too.

Identities and individual and institutional belief systems are only a part of the pedagogical complexity that teaching comprises. Each viewpoint has its own way of looking at the work of teaching and each may lead to different kinds of claims about the truth. One simple truth, however, is that there is no definite formula which says, ‘do this, and this will happen’. Burbules (2006) comments that it is:

“foolish to elevate any single approach to pedagogy ... different circumstances, different subject matters and different learners and an adaptability to circumstance provide the only intelligent approach to teaching.” (p.107)

Effective teachers are those who have classrooms where listening respectfully to the ideas of others is encouraged, where pupils learn to defend and argue their own position politely, where through the receiving, sharing and critiquing of ideas pupils develop their own mathematical knowledge and their own identities and in effect become mathematical thinkers in the same way that Lave and Wenger’s (1991) tailors absorb the intricacies of tailoring. This approach emphasises the importance of teacher generic skills such as subject, curricular and pedagogical knowledge but also indicates that many teachers will require new skills in order to create discourse opportunities. Findings from Walshaw and Anthony (2008) and Boaler (2009) indicate that teachers who are able to provide such contexts enable pupils

to have rich cognitive and social experiences that support the development of creative thinking and problem solving skills.

Other research emphasises teachers' thought processes in teaching. Shulman (1986) for instance points out that a major limitation of cognitive research has been the absence of any attention to the subject matter that has to be taught. He referred to this 'blind spot' (pp.6-7) as the missing paradigm. Shulman (1986) links teacher thought processes and behaviour towards pupil learning and terms this teachers' 'pedagogical content knowledge' which he defines as:

“The ways of representing and formulating the subject that makes it comprehensible to others ...alternate forms of representation, some of which derive from research where others originate in the wisdom of practice ... an understanding of what makes the topics easier or difficult: The conceptions and preconceptions that students of different ages and backgrounds bring with them to the learning of those most frequently taught topics and lessons.” (p.9)

Shulman's influential work, which identified seven categories of teacher knowledge, prompted other researchers to examine how teachers' pedagogical content beliefs might influence thinking, decision-making and style of teaching, for example, Peterson *et al.*, 1989; Hill & Ball, 2004; Ball *et al.*, 2008. It raised the problem of whether, when and where teachers might acquire or develop mathematical knowledge and if so, whether it stems from practice or professional development. It became clear that teacher knowledge of mathematics is crucial for improving the quality of instruction (Ma, 2010) and that the work that teachers are expected to do demands substantial mathematical skill. Teaching mathematics requires:

“An appreciation of mathematical reasoning, [an] understanding [of] the meaning of mathematical ideas and procedures, and knowing how ideas and procedures connect.”
(Hill & Ball, 2004, p.331)

Ball *et al.* (2008) elaborated on Shulman's (1986) concept of pedagogical content knowledge. Their emphasis was on *how* teachers need to know mathematical knowledge as opposed to knowing the content that they were teaching. By mathematical knowledge for teaching they meant:

“the mathematical knowledge needed to carry out the work of teaching mathematics.”.

(Ball *et al.*, 2008, p.395)

They hypothesized that Shulman’s (1986) category of content knowledge could be subdivided into common content knowledge (CCK) and specialized content knowledge (SCK) and his pedagogical content knowledge sub-divided into knowledge of content and students (KCS) and knowledge of content and teaching (KCT). Ball *et al.* acknowledged the difficulties in discriminating between some of these categories, for example, ‘specialized content knowledge from knowledge of content and students’ (p.404) but gave useful examples to define their categories. Their attempt to map the elements of pedagogical content indicates that there is further work to be done on linking specialized content knowledge in mathematics to the practice of teaching.

It is only recently that those responsible for the development of policy have acknowledged the finding that most primary teachers’ knowledge has been unevenly developed in primary mathematics (Williams, 2008) and actions such as the Mathematics Specialist Training Programme (MaST) have been put into place (DCSF, 2009).

One of the problems for researchers, policy makers and leaders in mathematics education has been the lack of knowledge about what constitutes effective professional development to improve teachers’ pedagogical skills. Teachers bring to the task of teaching a large spectrum of traits, which can be related to their psychological make-up, social background, economic condition, cultural capital, and social capital. Add these to their general education, pedagogical knowledge and pedagogical content knowledge and then ally these personal traits to those of their pupils, the learning context and the culture of the school and one can begin to understand how difficult it is to match training to individual needs.

Star (2005) argues that teacher knowledge can have either a superficial or a deep quality. He believes that it is difficult to consider or even name the knowledge that belongs in the deep procedural or superficial conceptual categories and he considers that this confusion makes it

difficult to identify “the kind of knowledge that underlies the flexible use of procedures” (p.408). Given this confusion about individuals and large-scale professional development programmes, it makes even more sense to support in-situ training that meets the needs of the community and the individuals within.

Mathematics researchers have usually defined procedural knowledge in terms of knowledge type (Goulding *et al.*, 2002; Baroody & Dowker, 2005), for example, by seeing procedural and conceptual knowledge as opposite ends of a continuum – i.e. from sparsely to richly connected knowledge (Baroody, 2004). However, although conceptual knowledge is not necessary for the development of knowledge about procedures, it is difficult to see how a procedure can exist without some understanding of the rationale behind it (Ma, 2010). Mathematical procedures are not produced in a vacuum; their steps are worked out according to principles and logic. Perhaps, therefore, deep procedural knowledge and conceptual knowledge cannot be separated.

Baroody and Dowker (2005) propose ‘Big Ideas’ (p.125) as a way of understanding concepts and procedures. Big Ideas are overarching concepts that connect multiple concepts, procedures or problems across or within domains and topics. They consider that depth of understanding is related to the degree to which procedural and conceptual knowledge are interconnected and “the extent to which that knowledge is otherwise complete, well structured, abstract and accurate.” (p.123)

The concept of Big Ideas is useful for teachers because one ‘Big Idea’ can serve a number of functions and help teachers make conceptual links when planning across different mathematical domains. Big Ideas invite teachers to explore below surface procedures and concepts and see that separate pieces of knowledge might have similar underlying structures. In short, Big Ideas seem to be important in the attempt to construct deep understanding of conceptual and procedural knowledge.

Rowland *et al.* (2009) investigated the degree to which teachers’ subject matter knowledge and their pedagogical content knowledge contributes to primary trainees’ teaching. They used the information to develop a conceptually based framework that they named the

‘Knowledge Quartet’. The 18 codes that they generated from watching videotapes of lessons were grouped into four main categories:

- Foundation
- Transformation
- Connection
- Contingency

with each unit composed of further subcategories. The ‘Knowledge Quartet’ begins to draw together much of what we know about the ‘how, when, where and why’ of teachers of primary mathematics. It begins by addressing teacher beliefs and the knowledge that a teacher already possesses as part of their personal education (*Foundation*). Shulman (1986) terms this stage ‘Comprehension’. Second, the Knowledge Quartet looks at how the knowledge that the teacher possesses is transformed into the act of planning and teaching (*Transformation*). This is akin to Schön’s (1987) ‘knowledge in action’ and echoes Ball’s (1990) distinction that there is a difference between knowing something for yourself and knowing in order to help someone else learn it. In the third category (*Connection*), the coherence of the teacher’s planning and teaching across one lesson or a sequence of lessons is considered. Apart from lesson observations, this draws on the work of Ball (1990), Askew *et al.* (1997) and Ma (2010), who found that effective teachers are able to use connected knowledge in their teaching. Inherent in the notion of ‘*Connection*’ is that in order to achieve depth and breadth teachers need to draw on their knowledge of mathematical hierarchies, their understanding of conceptual development and how they connect the ‘Big Ideas’ in mathematics. In the fourth category, ‘*Contingency*’ refers to teachers’ ability to ‘think on their feet’ (Rowland *et al.*, 2009, p.263). It looks at how teachers plan and respond to those unknown moments in a classroom that are not to be found in any text book. This often involves the ability to listen carefully in order to respond appropriately. Brown and Wragg (1993) consider this ability to listen and respond as the central factor of a successful lesson. They also consider it one of the most difficult skills to master.

The Knowledge Quartet is a useful tool for managers and researchers. First, because it focuses on how previously held and current knowledge might come into play in the

classroom and it forms a basis for discussion and self-evaluation. Second, it provides a framework for the researcher, a ‘memory jogger’ and a unit for analysis of teacher performance. It is significant that the tool incorporates what the pupil brings to the lesson and the teacher’s perspective and provides a means of analysing the interaction between the two of them.

2.15 In conclusion

Using my Critical Analytical Study as a springboard for further literature research has enabled me to deepen my understanding of key elements in action learning. Initially I felt overwhelmed by the range of literature I needed to absorb before I could begin to make sense of the procedures and processes. But I have now come to appreciate the power of communication, both non-verbal and verbal and I have had the opportunity to look in greater depth at learning and group theory that is more specifically relevant to my research. Learning to think mathematically is more than just learning to use mathematical techniques. Teachers have to make sense of their subject knowledge in relation to the knowledge held by their pupils and become active negotiators of meaning. In engaging in this they need to draw on a wide variety of skills, which they constantly develop over their professional careers. It seems to me that teacher identities are in constant flux and exposed to macro and micro influences including time, space and context. The ‘one-size-fits-all’ approach as advocated by the national strategy cannot meet the all of the separate needs of individuals or the institutions they work in.

The decision to experiment with action learning techniques was taken because I was looking for a new way of developing teacher knowledge. Teachers’ professional development has been connected to the national strategy for too long and I am not the only headteacher expressing concern about this straitjacket. Four of my colleagues elected to join in this research because of their levels of concern. At the time I did not know if action learning could provide any answers. It was only by the middle of the project that I began to see the power of the process.

Chapter 2 Review of the field

In the next chapter I explore my theoretical position, the design of the research and the process of collecting and analysing data. I argue that theory provides an essential base for action research and that without this foundation it is difficult to evaluate success. In order to achieve this, I begin to make the link between theory and action research more explicit and to explore how theory has influenced my actions and analysis.

Chapter Three

Research design and methodology

In this section I argue that using theory in action research is the bedrock upon which researchers test their ideas and the yardstick by which they will evaluate their interventions. I claim that using the case study method enables a researcher to begin with broad questions for analysis and then narrow the focus as time goes on thus offering the opportunity for depth of analysis contained within the unique environment of its case.

3.1 Using case studies for research

One of the primary qualities of the case study method is the depth of analysis that it offers. By depth I mean the richness of detail that is accounted for by explanation and analysis. A case study seeks to understand as much as possible about a single subject, or in the case of Set One, a single group. Indeed the selection of the method signals the presence of a particular element or characteristic that the researcher wishes to explore, in this instance, the qualities of action learning as a tool for teachers professional development. Wieviorka (2005) believes that case studies specialise in ‘deep data’ that can help bridge the gap between abstract research and ground floor practice by allowing the researcher to compare first-hand observations with the results obtained through other methods of research and theory. In Set One this interpretation of a case does not necessarily have to yield an analytical category but may be used to learn more about reality.

The case study approach is also a flexible method of research. Its design emphasises exploration rather than prescription and a researcher has greater freedom to explore issues that arise. With hindsight I also see that the loose format of case studies allows a researcher to begin with broad questions and then narrow the focus as time goes along.

White (1992), cited in Ragin, (2005), claims that the design of a case study should depend on its ‘mission’. (p.91) and defines mission as the search for identity or as a vehicle for

experimentation or identity. White claims that the whole point is to limit the environment so that the responses can be analysed in depth.

Set One fits White's definition because its identity is limited by its operational rules; only open-ended questions may be asked and so in this sense it operates within a limited environment. The responses from the presenter of the issue in theory cannot be answered by one-word answers and there are rules of engagement through the dialogue in Set One.

Case studies however have been criticised for their subjectivity (Wieviorka, 2005) because their approach relies upon personal interpretation of data and inferences and their results may not be generalisable. Relying upon one or a small number of subjects for cognitive explanation also runs the risk of inferring too much from limited circumstances. Other weaknesses in the approach specify ethical considerations; the personal integrity, sensitivity and possible bias of the researcher in analysing interviews and questionnaires leaving investigators open to the accusation of unknown gaps and partiality in the study.

This weakness of the case study method is explored by Geering (2004) who described the method as a 'definitional morass'. To refer to a work as a case study might mean:

- That its method is qualitative;
- That the research is ethno- graphic, clinical, participant-observation, or otherwise "in the field";
- That the research is characterised by process-tracing;
- That the research investigates the properties of a single case;
- That the research investigates a single phenomenon, instance, or example.

(Geering, 2004)

Geering also noted that Yin (1994) had identified some specific types of case studies:

- Exploratory; undertaken as a prelude to social research.
- Explanatory; may be used for doing causal investigations.
- Descriptive: requires a descriptive theory to be developed before starting the project.

whilst Stake (1995) included three others:

- Intrinsic - when the researcher has an interest in the case.
- Instrumental - when the case is used to understand more than the obvious to the observer.
- Collective - when a group of cases is studied.

In all of the above types of case studies, there can be single-case or multiple-case applications. Set One is essentially an exploratory case study although it also has intrinsic and instrumental aspects; it prepares the ground for Set Two by experimenting with action learning techniques and the study's conclusions suggest that there are significant variables that emerge.

Ragin (2005) maintains that case study research is all about “casing”—defining the topic, including the hypothesis(es) of primary interest, the outcome, and the set of cases that offer relevant information whilst Walton, (1992) (cited in Ragin, 2005) claims that there is a fundamental duality in all cases, namely that they are:

‘situationally grounded [but also] limited views of social life.’ (p.121)

Wieviorka (2005) acknowledges this but additionally claims that a case is also an opportunity to connect fact and concepts to reality and hypothesis; a case is defined by its uniqueness because it cannot be observed either before or after the event.

3.2 Theory and action research

When I first embarked upon this research I was attracted to positivist theory because it provided a close link to my initial construct that there was an answer ‘out there’. My understanding of positivism is that it is a position that advocates applying the methods of scientific study to social reality (Cohen *et al.*, 2005). Positivists aim at systematic observation with rigorous guidelines; they look for regularities and focus on what can be observed. A positivist, for example, would seek to explain a phenomenon by looking at external causes, the idea being to build up as much knowledge as possible by studying the effects. A key idea is that of cause and effect: there are patterns across time in organisations

and between people and a 'cause' will produce a specific effect. Knowledge of a particular kind is gathered through facts that provide the basis for laws, whilst the purpose of theory is to generate hypotheses that can be tested (Bryman, 2004).

This is very appealing, but I have come to understand that separating theory so distinctly from research underplays human interaction and makes the link between education and research too technical. My work has led me to believe that one depends upon the other. I now see that the attempt by positivists to develop laws about human behaviour, in which trends and patterns can be observed, seems to neglect the complexity and unique contexts in which educational practice takes place. I have also discovered that trying to establish validity within positivist principles can constrain rather than help to explore qualitative data. This is because I see that it is impossible to control the action learning sessions in the sense of isolating what is said and done from one session to another: replicability cannot therefore be ensured. As an action researcher trying to find answers and create meaning from events, I have learned that I must try to see events from multiple points of view, understand from the participants' perspective, and remember that such knowledge is context dependent.

Exploration of the links between theory and action research has revealed a wide spectrum of opinion. At one end of the spectrum, theory and action research appear to be uncomfortable bedfellows. Dick *et al.* (2009) note that there is very little in the action research projects on the building of how "thought derives understanding from action" (p.6), which is puzzling because in the action research cycle of Zuber-Skerritt (1996) that I have elected to use, thought guides the action which in turn guides thought. Dick *et al.* (2009) also point out that very few action researchers explain the theory that guides their action, yet before researchers act they must hold some theory, even if it is informal knowledge and understanding. At the other end of the spectrum, I think, are the action researchers who use theory to describe the dynamics and processes of the research in which they are engaged. My experiences as a researcher and educational manager lead me to believe that theory has a strong place and function in action research, because without it, it is difficult to frame the experience within its context. By making use of theory I hope to be able to generate plausible explanations for

what happens in my research. I know that learning is a complex practice because problems change from one setting to the next. I also know that if I am to help my school I need an approach that can transfer actionable practice into actionable knowledge.

Some action researchers, for example Gergen & Gergen (2008) believe that theory should be subordinate to practice in action research. I would make three observations: first, without theory it is difficult to explain relationships because there are elements that may be invisible to participants. In the Critical Analytical Study, for example, I learned of the importance of three associated things: belief systems, the unconscious motivations of staff and the power of organisations in the development of identity. I also began to understand how learning theory had contributed to an understanding of how people learned and the role of powerful organisations in promoting or impeding this.

Second, I maintain that establishing a theoretical position is crucial to validity in research and that it should hold at least equal footing with practical outcomes. In this piece of action research I intend to use respondent and pragmatic validity as I feel that they best fit the multiplicity of the field of practice I am working in.

Third, I need to consider my own leadership and theory. Over the last five years I have learned how to be more in tune with myself, less likely to be buffeted by external change, and I hope that I have become more knowledgeable how I, as a leader, affect others. I have come to understand that I depend on theory because I cannot empathise with my staff, pupils, parents and community, and serve them through leadership without being aware of my own fundamental beliefs and values.

3.3 Action learning: a tool for action research

Action learning is the tool by which the action research is conducted. It is a vehicle for organising the manner in which a discussion can be held. By the very nature of its questioning it sets out to be evaluative and analytical and promote reflection on action, whilst being ‘in action’ (Schön, 1987). An action learning set deliberately sets out to provide time and space for the presenter of an issue to reflect on a problem or an action that has been

undertaken and how they may move forward. In a set, there are clearly defined roles; that of presenter (of an issue), a facilitator and set members. Ground rules, explained by the facilitator, remind the set that advice cannot be given to the presenter and that all dialogue from set members should be framed in terms of open-ended Socratic-style questions. Issues of trust and confidentiality are stressed to all members. Set members must also suspend judgement, refrain from approval or disapproval, and accept the story from the presenter. The facilitator is responsible for time keeping, ensuring one person speaks at a time and that questions remain within the Socratic style and are not 'leading'.

The facilitator first leads a short 'introductory' activity and then invites set members to consider presenting an issue. Each presenter may recount a concern any way they wish. Set members listen before beginning to question the presenter. If the questions are well constructed and sufficiently open-ended, the presenter is encouraged to evaluate their position and reflect on what actions were taken, what actions might have been taken and what might happen next. Set members try to understand the presenter's point of view and what it means to the presenter as a 'knower' of that experience. In theory, the set continues until the facilitator indicates that the allocated time is up. There does not appear to be any recommended time given for the life of a set. In Set One, the model created for this research, a timescale of one year was given to the six sessions, interviews and debriefings.

3.4 Ontological and epistemological choices

Action research is full of choices and, as a result, consequences. I believe that one of the prime purposes of action research is not just to describe or interpret our world but to forge a more direct link between theory, intellectual knowledge and social action so that:

“inquiry contributes directly to the flourishing of human persons, their communities and the eco systems of which they are a part.”

(Reason, 2006, p.188)

This suggests that the form of action research selected is likely to be driven by a particular epistemological and ontological stance, which in turn may affect the researcher's role, relationships with participants and the validity criteria applied.

In selecting the action research model as the most appropriate, I have returned to my Critical Analytical Study, re-reading the work on Habermas (1971) and Bourdieu (1977). In doing so, I begin to see that I am, at heart, an interpretive researcher and I recognise that I am part of, rather than separate from, the community that I am researching. This is first because not only does my presence impact upon the members of the community but in turn their thoughts and experiences impact upon me as a researcher. Second, it is because the community members are also part of my research and they have placed their trust and confidence in me as a researcher and a colleague. I need to explore their dialogue and interpretation of events and perspectives on mathematics from more than one standpoint and at least from their individual and collective perceptions.

My social constructivist approach leads me to believe that meaning can be constructed both in and through interaction. Habermas indicates that this stance is not without its problems. He notes that if social reality is assumed to have an independent existence, we can never know what this social reality really is because of our actions and our socially derived modes of engagement. I have tried to make sense of this in terms of my own experience and concluded that reality has multi-perspectives. Accounts of what we do are affected by context, beliefs and personal identities and I should be aware of this when trying to analyse and interpret my data.

3.5 Paradigms

Grogan and Simmons, (2007)), usefully define the three dimensions of a research paradigm, explaining how the three perspectives, ontology, epistemology and methodology are linked. From the perspective of the transformative tradition, they see them as:

“encompassing critical perspectives and ... the nature of reality and the relationship between the knower and what is to be known.”

(Grogan & Simmons, 2007, cited in Briggs & Coleman, 2007, p.38)

After considerable reflection, some doubt and an initial reluctance to adopt a stance too early on, I found myself operating in the transformative tradition, accepting that reality can be shaped by conditions such as historical, social and political circumstances. However, in attempting to understand how research evidence may be understood, I have moved, over the last four years from a positivist position (where I believed that it was possible to develop correct methods for understanding educational processes) to the interpretivist position (where I recognised that reality was not ‘out there’, and answers were not going to tumble into my lap). This transformation did not happen swiftly and I was not aware of my shifting stance. It was a result of a combination of factors that included exposure to challenging social and political realities, and academic reading and discussion.

Within this tradition I also note that I was attempting to create understanding *with* the members of my research community instead of *for* them. We were looking beyond the limitations of the national strategies and the national curriculum and searching our experience, our identities and our beliefs as we explored complex problems.

When I committed myself 24 months ago to a participatory action research model that aligned itself with the perceived needs of a community, I decided that the following elements should at least be present in the research project:

- That it should be grounded in a lived experience;
- That theory should have at least an equal footing with practical outcomes;
- It should be developed in partnership;
- It should address significant issues;
- It should help people to find new ways of interpreting their world;
- It should leave some kind of infrastructure in its wake.

Committing myself to participatory research meant that I was recognising the dual impact that the researched and researcher have upon one another, but I was also using participatory

research in another way; trying to explore the meaning of transcribed data from the multiple perspectives of my Set One members.

The model that I have elected to use is that of Zuber-Skerritt (1996b). It follows the action research cycle codified by Lewin, (1946) ,cited in Zuber-Skerritt,1996, with four main stages: planning, acting, observing and reflecting, and it incorporates single and double loop learning. It is a particularly useful model because it looks at the forces that can impact on and impede change in schools, and it pays greater attention to context than most other action research models. Zuber-Skerritt integrates two models of organisational change; first, Beer *et al.*'s (1990) linear model, and second, Lewin's (1952) model of organisational change, which she extends by one step and then combines with her own model (*Figure 3.1*) which she calls, "a model of emancipatory action research" (p.99). She calls it emancipatory, because she notes that the key elements in her model are those of critical and self-critical reflection, which she believes to be:

"emancipatory, empowering, transformational and therefore effective only if subsequent steps are taken to transform the system and to make changes to those conditions in the organisation which impede real change and improvement."

(Zuber-Skerritt, 1996, p.99)

Zuber-Skerritt's use of Lewin's (1946) notion of successful organisational change was based on three aspects: unfreezing the present level, moving to a new level, and re-freezing group life on the new level. For Hawksridge the unfreezing process had three phases. First there was enough discomfoting data to show that the school was mathematically weak when compared with national results. Second, the learning goal resulting from this weakness was to improve performance in the field; and third the anxiety levels that this weakness produced was enough to convince the school to embark upon major change.

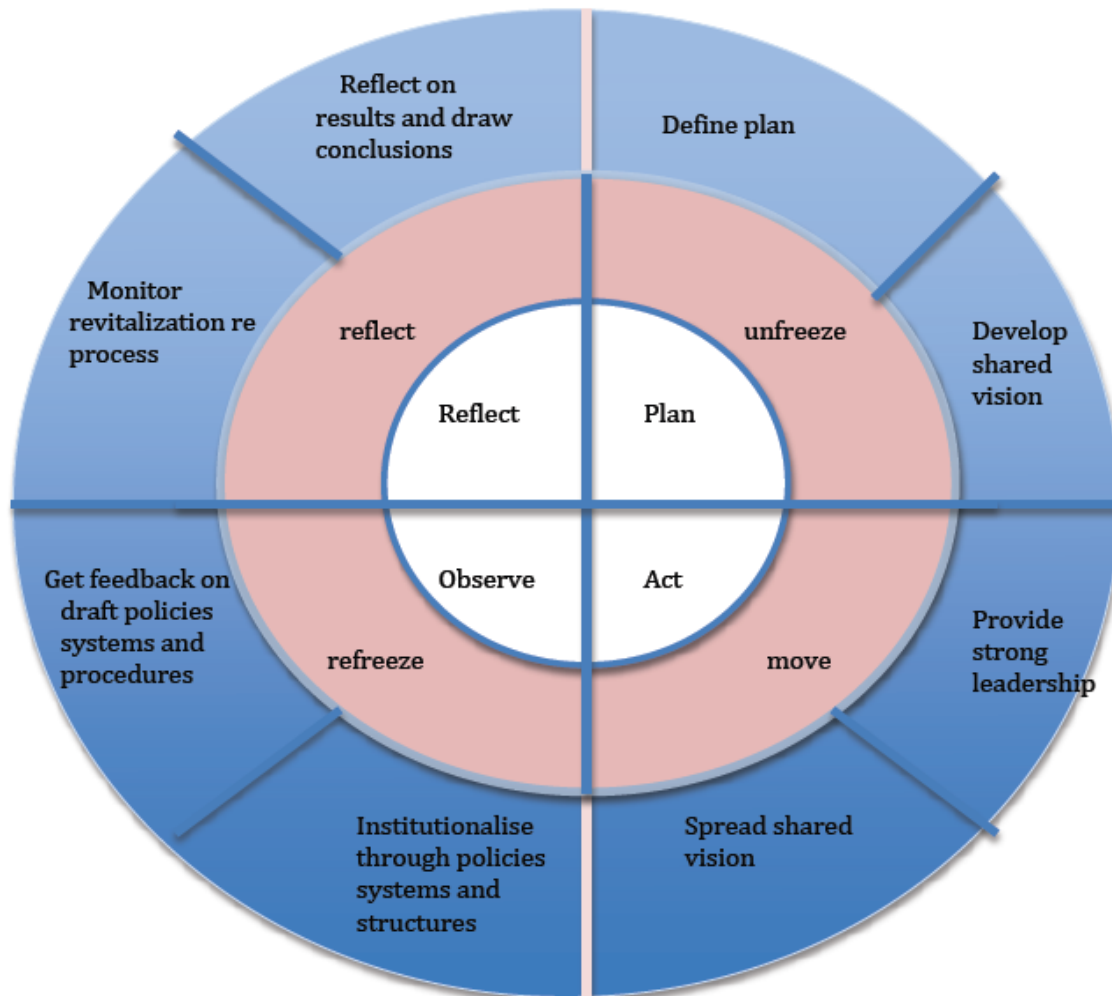


Figure 3.1: Zuber-Skerritt's model of model of emancipatory action research applied to Set One and Set Two

Set One fits into the action research cycle in the first half (plan/unfreeze, act/move). It met once every half-term at one of the five schools. It was planned action, which might enable Hawksridge to develop a shared, collaborative vision of what mathematics should look like in its own particular school context. Set Two falls into the second quarter of the model. The original plan was to integrate the action learning procedures in the summer of 2009 as a regular feature of staff meetings about mathematics.

In action learning Set One Hawksridge was creating an action research project for the purposes of whole school action research (a project within a project). It was at this point that

I struggled with my insider-researcher self against my managerial self. I did not know what the impact of either project was going to be. With hindsight, I now see that the ability to tolerate uncertainty plays a central role in any organisational change. However, it is one thing to suffer disequilibrium on a personal level, but something entirely different to persuade others to change and get them to believe that by changing their practice, their own performance will improve and children's mathematical capacity to learn and understand will improve. The aim of action learning Set One for Hawksridge was to see if the model could be used to persuade teachers to reflect on and rethink their mathematical practice, and become aware of how they might use their created knowledge to improve their performance in the classroom and as managers.

This sounds very simplistic and I am aware that teacher change is complex. Action learning is essentially a dialogic model and I did not know in the early planning stages to what extent the use of language could capture the essentials of improving teachers' mathematical skills. I was aware that collaborative discourse could be very powerful but had little idea of its extent; experimenting with a model before unleashing it in the school created a safety net. I took some comfort from Butler (1999) who points out that one can become mathematical in multiple ways and that discourse is one of the ways in which this can be constituted. She suggests that it is through our use of language that we become more (or less) mathematical in different situations and that collaboration can generate new and shared understandings.

Zuber-Skerritt's model, however, is insufficient on its own because it does not take account of the external pressures that made it difficult for Hawksridge to operate and plan for improvement. From September 2002 to 2006 Hawksridge had the appearance of a fragmented institution. It had little capacity for sustained improvement because of high staff turnover, high pupil mobility, an inexperienced senior management team, and it is situated in an area of high poverty and crime. It seemed an unlikely candidate for action research, but by September 2007 Hawksridge was not inactive: it was beginning to think for itself, to view collaborative learning as a key way forward and Set One was part of its pathway.

Conditions were also more favourable for the school in September 2007. Hawksridge had bought itself a window of opportunity with an improved set of test results. This gave it greater confidence and, additionally, it was beginning to form a nucleus of staff that could think beyond the constraints of advice provided through the national strategy.

3.6 Characteristics of the schools

The four schools in the study (the fifth being my own, Hawksridge) were self-selected by their headteachers and are all within one London inner city local authority. They conveniently provide a range of urban contexts when data provided by the headteachers is compiled.

Table 3.1 shows the characteristics of the schools and their set members. This data is available from individual school's RAISEonline 2009 (Reporting and Analysis for Improvement through School Self-Evaluation) and was provided by the headteachers.

Table 3.1: RAISEonline details from participating schools.

	<i>FSM</i> %	SEN %	Over- crowded households %	Length of time headteacher in post	Length of time mathematics coord. in post	Deprivation Indicator (National mean is 0.27)	Set members
Hawksridge	63	31	46	8 years	2 years	0.57	D. J1. E.Z
Ashton	19	21	33	19 years	7 years	0.29	A. J3
Park View	52	29	45	10 years	15 years	0.29	J2, M
Hampton	22	16	21	13 years	2 years	0.14	P. R
John Fisher	47	32	44	8 years	3 years	0.55	Q. T

Each school has its own pseudonym and each set member a coded initial or combination of letter and number (*Table 3.2*).

Table 3.2: Roles of Set One members in own institutions

School	Institution Role and Characteristics
Hawksridge	D. Joined Hawksridge as a Newly Qualified Teacher (NQT) at the same time as the researcher. D is the mathematics coordinator.
Hawksridge	J1 Joined the school as a NQT. Became a senior manager for literacy at the beginning of the research project. Has been at Hawksridge for three years.
Hawksridge	E A senior manager for SEN. Has been in post for 33 years.
Hawksridge	Z New to the school. Leading KS2 teacher. Has three years of experience in other schools.
Ashton	A Has been a headteacher for 19 years in the same LA. Was the Deputy Head at a school where the researcher taught in the 1980s.
Ashton	J3 Teacher and mathematics coordinator. Not known to the researcher before the project. On the government Maths Specialist Training programme.
Park View	J2 Headteacher. Known to researcher because part of same Education Action Zone (EAZ). School is closest to Hawksridge.
Park View	M Mathematics coordinator and Year 6 teacher. Also the deputy headteacher. Not known to the researcher before the project.
Hampton	P. Established headteacher in the LA. Keen interest in research and willing to experiment with new ideas.
Hampton	R Teacher and mathematics coordinator. Class based. Not known to researcher before Set One. Had not been in post long although not a new teacher to Hampton.
John Fisher	Q Headteacher. Interested in new ideas and needing to move her school forward. Was a member of the same EAZ.
John Fisher	T Teacher and mathematics coordinator. Not class based. Acting senior manager. Not known to the researcher before the project.

All of the schools are described as providing a satisfactory or good standard of education in mathematics as evidenced by OfSTED reports. All teach children in mixed ability year groups. Four of the schools' populations include children from a wide range of ethnic and cultural backgrounds. The fifth, Hampton, is primarily white, lower middle-class.

3.7 Research design and data collection methods

The original model (Set One) required that headteachers and their mathematics coordinators should commit to the project. This was because they were perceived to be the ‘power-brokers’ in their schools and without their approbation it was unlikely that the project would develop. The action learning sessions took place over a period of one year, with meetings designed to be held every half term (*Table 3.3*). Each session ran for approximately one hour with at least five members present on each occasion. The main corpus of data was generated from six tape recordings and transcriptions from Set One action learning sessions and six follow-up interviews. In addition, there were six sets of follow-up questionnaires relating to the running of the sessions, three final interviews with the headteachers, and four final interviews with my senior managers who took part in all sessions.

Follow-up interviews were undertaken within three days of the action learning session. Headteacher interviews took place in the term after the sessions concluded, with interviews lasting from 40 to 60 minutes. Interviews with my senior management team also took place in the term after Set One finished, although by this time Set Two action learning sessions were already happening at Hawksridge. Including the initial introductory session, a total of 23 hours over 17 months was spent in the field, discounting the time spent on questionnaires at the end and time spent organising meetings and follow up interviews

Survey methods (*Table 3.3*) used voice recordings of action learning sessions, semi-structured interviews and questionnaires. Some of this data was easy to process – for example, the end of session questionnaires. However, this approach also had a set of limitations in that one only gets ‘one shot’ from a survey style questionnaire and the context – ‘the when, where and how the questionnaire is filled in’ – was open to abuse as set members occasionally prompted each other. To compensate for this I decided to use my research diary to provide descriptions of the context, and social behaviour of members during sessions. The strength of this approach was that it was continuous, although it was not unobtrusive since the presence of the researcher at meetings was likely to impact on actions

in a myriad of ways. I did not write up these observations during the sessions but learned to listen and observe on a continuous basis. This was harder than I had anticipated: I was initially too interested in the questions and found it hard to focus on behavioural aspects.

Table 3.3: Research design diagram showing each method, with whom and when undertaken

Method of Collection of Data	With Whom	When Undertaken
Taped action learning sessions and subsequent transcriptions	Session 1 Session 2 Session 3 Session 4 Session 5 Session 6	September 2008 November 2008 January 2009 March 2009 May 2009 July 2009
Semi-structured interviews with presenters of issues and transcriptions	J1 J3 Z R T P	September 2008 November 2008 January 2009 March 2009 May 2009 July 2009
End of sessions questionnaires	With all set members present at the end of each action learning session	September 2008 November 2008 January 2009 March 2009 May 2009 July 2009
Unstructured interviews (transcribed)	With three headteachers (fourth presented final session)	September 2009
Unstructured interviews (transcribed)	With four senior managers from Hawksridge staff	September 2009
Research Diary	Used: <ul style="list-style-type: none"> • after action learning sessions • whilst analysing transcripts • whilst reading research papers/literature • during my working day 	Continuously from the Evaluation Research through to Sets Two and Three April 2007-December 2010

3.8 Ethical considerations

Ethical guidelines initially seemed simple, but action research is fraught with ethical dilemmas. When I originally explained to my senior management team and professional colleagues what I proposed to do for my research, I probably only shared half the story with them. The other half developed as I continued to read, write and observe. The original intentions were simple, as expressed in the title of this piece, but in the analysis and writing of it, I am probably guilty of seeing it from my own perspective. Whilst I was always honest about the collection of data and scrupulously careful in transcription and return of transcripts, I did not share with my colleagues the theories that I was about to use to make sense of the data. Indeed I do not think I was clear at the outset which ones I would use and which not. I used the university guidelines as a framework to make sure I had declared my intentions, but these changed over the course of the two years of researching and writing, partly because I was still developing my skills as a researcher.

Researching from the view of the ‘insider practitioner’ meant managing more than one ethical identity. My staff trusted me to do the best I could for them professionally, and I considered it to be unethical and unprofessional to do otherwise. My dilemma lay with my researcher self and being true to the data. By positioning Set One outside my workplace I resolved this to some degree, but not entirely. I recognise that I have made use of my insider knowledge on more than one occasion, but also that this knowledge has given me a depth and breadth which could only be gained by being in close proximity to my colleagues on a day-to-day basis. Research and practice thus came to inform each other (Drake, 2011) and it was sometimes very hard to position oneself between them.

My potentially conflicting roles as the researcher and agent of change require careful examination. Mirvis and Seashore’s (1982), contention (as cited in Nolen & Vander Putten, 2007) that most ethical issues arise “not because roles are unclear but because they are clearly in conflict” was in my mind when originally negotiating and discussing boundaries with the Set One members. I was determined that what I learned as a result of action research would stay anonymous and with the project.

Whilst external boundaries did not shift a great deal during the initial Set One period, I gradually became more acutely aware of the complexities of insider research. The National Research Council's (2003) principle that there is an obligation to, "treat individuals as autonomous agents whose decisions on whether or not to participate in research are to be respected" (p.81) suddenly becomes very difficult when three of my teaching staff are asked to take part in a piece of research that is convened by their headteacher: the fourth was adamant that she was not going to be left out. It would be difficult for them to decline, particularly as the research had been presented as a part of our work to improve mathematical standards. All of the participants in Set One signed the Informed Consent form and did so before the commencement of the sessions. However, this raised another ethical issue: how can participants give true informed consent when they do not know what the proposals may bring about or what changes may occur as part of the action research process?

A second aspect of respect for persons involves confidentiality. Although I have coded all of the schools involved and not used any identifying initials in the transcripts, the participants would have little difficulty in identifying each other. I have not used the internet to send any transcripts to any members of Set One but have hand delivered them when I next saw them. In this way I hope that only the members of the community will be able to identify the key players. Members who were not present at a meeting have not had access to the transcripts.

3.9 Research design problems

Initial difficulties centred on the quality of recording conversations. When the whole group were together (12 in total), one recording device was insufficient to capture all of the speech. This meant the first taped recording was of very poor quality. Although I had written down the questions asked in the first meeting, I could not hear the responses clearly on the tape. The second attempt using a microphone attached to the recorder only picked up the set members seated in the middle of the table. The final solution – two tape machines – went some way to solving the problem but it was still difficult to hear members with low voices and catch all that was said from rapid speakers.

Table 3.4 Timeline of events for action learning Set One

	September 2007	March 2008	May 2008	July 2008	August 2008
Pre-Implementation	September 2007 Evaluation Research recommendations emerge	March 2008 Four headteachers volunteer to be part of any future research following L.A. conference	Exploration of action learning with Pat Drake as a vehicle for school improvement	Introductory session for Set One members. Pat Drake facilitates, plus four headteachers, four mathematics coordinators, Hawksridge Senior Management Hawksridge Chair of Governors. Informed Consent Form distributed.	September 2008 Critical Analytical Study points way toward a mathematical community of practice
Early Implementation First three sessions	September 2008 First meeting. 12 set members attend. Too many observers and not enough participation. Difficulties with recording conversation. Questions manually written down but not responses Semi-structured interview debrief of presenter (taped). Questionnaire returns collected. Begin to transcribe data Transcription returned to presenter		November 2008 Second meeting Transcriptions given to first meeting attendees 5 set members attend Struggling to maintain the dialogue. Re assessed role of facilitator. Experimented briefly with no facilitator. 2 tape machines used New dates set for spring term Debrief of presenter and transcription of taped conversation. Questionnaire returns collected Transcription returned to presenter. Concern re voluntary nature of some set members	January 2009 Third meeting 8 set members present Return of transcripts to previous attendees. Development of 'stems' for questions for set members Debrief of presenter and transcription Questionnaire returns remain positive with some requests Return of transcription to Presenter	
Later Implementation Final Three Sessions	March 2009 Fourth meeting 8 set members attend. Improved question flow Hampton headteacher requests that action learning Set Two should begin in her school Hawksridge Senior Managers request that action learning should be implemented in own school. Set Two at Hawksridge begins in April 2009 Set Two begins at Hampton in April 2009 Debrief of presenter and transcription. April 2009 Return of transcriptions to presenter and relevant set members	May 2009 Fifth meeting 7 set members attend Transcriptions returned Set one tests boundaries by considering a mathematical managerial problem. Evidence of improved listening and collaboration Debrief of presenter and transcription. Positive feedback from set members verbally and from questionnaires	June 2009 Sixth meeting 9 attendees Set considers managerial issue	September 2009 Debrief of three headteachers and transcriptions. (1 of very poor taped quality) (Debrief of mathematics coordinators already completed after presentations) Debrief of Hawksridge senior management team members (four) Return of transcriptions to relevant set members Analysis begins	

Other design problems surfaced as time went on. Although I had considered ‘drop-out’ and unavailability, it nevertheless proved extremely difficult to find dates that the whole group could manage. Ultimately, the whole group of 12 only convened for one session during the year. This had mixed blessings. Recording such a large group was difficult and, additionally, some members in such a large group were noted as being observers rather than participants. My research diary notes that members were much more active when in a smaller group (p.132). The average group size for Set One was eight, the range being from five to twelve. However, five was too small and the group felt as if it was labouring (research diary, p.141).

The venue proved to be relatively uncontentious. Initially, I had worried about this: I did not want members to find it difficult to reach schools or have to pay car-parking charges. Hawksridge had the benefit of having the only free parking outside the school but I did not want it to be seen to be the host for all meetings. I wanted all of the schools to feel that they had a stake in the project and, rightly or wrongly, I felt that this was more likely to be realised if we moved around to the different schools.

Headteachers usually selected a small room for the meeting. This made recording easier. Not using a classroom or the headteacher’s room was important for the sessions. There was a sense that we had moved away to a place where we could think about mathematics in a different way. As one member said:

‘...you can shut the world out and think, “OK we’re here to talk about maths.” ’

Small rooms ranged from nurture rooms, small library areas and rooms devoted to Special Educational Needs.

My early readings on action learning hinted that a session should take up at least two hours (Brockbank & McGill, 2004). This was impractical. I had planned to hold the Set One sessions after the end of the school day and I knew how stretched teaching staff were in terms of the end-of-day tasks which they must fulfil. If the sessions were to be useful they needed to fit into existing formats, namely staff meeting times, and union demands at

Hawksridge dictated that this could not be for longer than one hour. Sessions therefore needed to be highly focused and time-bounded. This was constricting but I reasoned that if action learning was to be a regular part of our work, then we must adjust the parameters and adapt the model to make it work.

3.10 Interviews

There were two types of interview. In early follow-up visits with presenters of issues, I used a semi-structured interview that first focused on initial reactions to the action learning process and then picked up potential problems and issues that arose during the meeting. These interviews had items such as:

- Do you feel that action learning sessions are useful to you?
- How difficult is it, being faced with only open-ended questions?
- How do you think you could use this type of questioning?

Second, I had unstructured interviews with three of the headteachers. Initially, I had prepared some starter questions, and so I began with the same question:

‘Do you feel that the action-learning project has been a useful experience?’

I then used the responses to follow up ideas and thoughts. This was because it became apparent that individual contexts meant that each headteacher perceived the project entirely differently. One headteacher, for example, planned to use it as part of her performance management policy and another for developing classroom questioning.

3.11 Triangulation

I have attempted to triangulate data by collecting questionnaires at the end of meetings and by debriefing presenters after sessions. I have noted that Cohen and Manion (1994) claim that this “methodological triangulation” (p.98) may lead to invalidity as some set members may not complete the questionnaire accurately. A part of the triangulation also includes respondent validation because I have returned transcripts to the set members present

at each session and the debrief transcripts to those I have interviewed. This might reduce the risk of bias (Scott & Morrison, 2006, cited in Briggs & Coleman, 2007). I have kept an audit trail via diary entries to ensure emergent or unexpected design trails have been noted.

3.12 Research journal

I have also attempted to triangulate my data through participant observation. I did not take part in the discussions, instead I learned to listen and record my observations. At first I was mainly focused on attitude to the project, but then I began to focus more carefully on my research questions:

- Could these experienced practitioners make use of their pedagogical knowledge to drive forward mathematical thinking?
- How well could they draw on subject knowledge to support the presenter's quest for understanding?

The research diary became a tool for reflection and contemplation after each meeting, first analysing the questioning and process, and second, considering how I could use the data to help Hawksridge move forward. In addition to this I recorded chance comments from my own members of staff in a variety of settings, ranging from their classrooms (formal school monitoring) to casual conversations as part of the day-to-day running of the school.

3.13 Action research and validity

A central issue in qualitative research is validity. I am aware that when trying to construct meaning from transcripts of conversations the interpretation is very much related to my own stance and particular educational concerns. I am conscious that I have a vested interest in making this action research work because of my own professional needs as a headteacher and that this is a source of tension. I also know that words can be slippery (Dunne *et al.*, 2005), and that there is a danger that I will imbue them with my own meaning and from too narrow an angle. When considering the validity of the research I have endeavoured to keep the following in mind. As far as possible I know that I need to establish:

- Trustworthiness in my data;
- Credibility in the outcomes and dependability on the methods I have selected;
- Consideration for the transferability of the research.

(Cohen *et al.*, 2005)

I am also aware that in selecting a particular type of validity, I am consigning other versions to the metaphorical bin, and I worry that this affects the integrity of my work. In order to negate this as far as possible, I have tried to locate my choices within my research paradigm. I now feel that I am essentially an interpretive researcher and that this stance requires that I check my interpretations with the Set One members. On this basis I have elected to use respondent and pragmatic validity checks because I feel that they best fit the diversity of the field I am working in. They are not only valid for a specific situation but they can be adjusted according to the context of each action-learning meeting. This is not a controlled experiment; it is a real life situation in which not all variables can be identified. The complexities of real life mean that I cannot assess the success (or failure) of action learning techniques with any certainty, however much I would like to.

There are several different ways of establishing dependability as described by Lincoln *et al.* (1985). They suggest that credibility can be addressed through peer debriefing and member checking, and so I have attempted to ensure respondent validity by submitting transcripts of action learning meetings to those who attended.

Pragmatic validity looks at research from a prescriptive-driven perspective. It is useful in this research project because it considers that solutions to problems that occur in one multivariable field of practice, which are developed and valid for one specific situation, can be adjusted according to the situation in which they are applied. In action learning Set One, for example, the members changed on each occasion. I have attempted to ensure pragmatic validity by careful observation of processes so that the protocol and techniques can be used elsewhere.

3.14 Interpersonal issues

The decision not to take part in the action learning sessions as a facilitator, presenter of an issue or a set member, and to remain in the role of observer was taken early on. The primary reason for adopting this position was that I hoped that my continuous presence would gradually become unobtrusive and that I could begin to isolate characteristics of the sessions. I would then be able to begin to explain how the set members responded and made sense of the challenges to their ways of thinking and working. I decided not to write during meetings because I felt that members might feel I was reporting on their skills, thoughts and responses. Instead I chose to listen carefully and write up observations afterwards. This *modus operandi* undoubtedly distilled the sessions and depended upon memory, but it also maintained a working balance with experienced teachers who were drawing on their knowledge and skills in a new way.

Ethnographic methods such as these were also useful for their flexibility. Weaknesses in survey design could be compensated for by being responsive to session characteristics. So, for example, although I had not intended to debrief the headteachers at the end of the action learning programme, I realised that I needed to know the extent to which the work had been useful and how they might develop it. These final interviews were interesting because of the different perceptions of the headteachers, who tended to view action learning as a tool in a different way from my original conception. I cannot pretend that I approved of one of the proposed uses, since it was related to performance management issues, and by the latter stage of the research I had an inkling of the power of action learning and how it could be used unwisely. There was something strange about this final interview. The headteacher appeared disengaged from reality and I made the decision not to use the data. The final interviews with my own four members of staff who had been deeply immersed in the project on two fronts (Set One and, by April 2009, Set Two) were prompted by the improvement in their performance as classroom teachers and school managers.

Tensions as a facilitator could not be avoided; I was aware that I possessed more than one identity in the group. I was the researcher (for all) and line manager (for some) and colleague

(for others). Additionally, my position and perceptions could affect, or be affected by, power relationships and cultural norms. I knew that in the focus on process, a quality partnership required emotional as well as intellectual involvement, and I needed to find a way of relating to and working with this. I was also aware that because my research focused on dialogue, it was important to remember that language is not just a technical matter – it can be an expression of culture and power.

The political dimension of education is currently a minefield. One has to negotiate the external politics of outside organisations such as OfSTED, and meet the demands of the local authority with their emphasis on national strategies, floor targets and the Every Child Matters agenda. Equally importantly one must negotiate the internal politics of one's own school and the sensitivities of the participating school communities. Whilst I did not receive any help from the local authority until the end of the project, neither did I experience any obstacles, for which I was grateful. The assistance of the local authority's City Learning Centre in helping with the downloading of taped data into a manageable form at the end of the project was invaluable. I was also reminded that no one acts neutrally in such circumstances and everyone has a political agenda (Drake & Heath, 2011, p.22).

3.15 Colleague motivation

A third application of the principle of respect lies in my relationships with the participants and, more importantly, their perception of the voluntary nature of participation in the research project. My own staff attended freely but after the first session they commented the next day, with some amusement, on the negative body language of one of the coordinators, who was clearly not sure she wanted to be in the set. At the first meeting the voluntary nature of the research was stressed and one coordinator did drop out and another attended sporadically, although her headteacher continued to attend all of the sessions. As a senior manager and researcher, I felt that all the members of Set One had a right to attend but headteachers did not have the right to insist on the cooperation of others. This probably added to the complexity, since all of the headteachers had initially requested involvement and at least two seemed to expect their coordinators to fall into line. In terms of my own

staff, we reached an agreement after the first meeting that we would not discuss anything we had observed or learned during our sessions and we assiduously kept to this arrangement.

My position as an internal researcher was also complex because I could never entirely remove myself from the situation I was studying. This made it difficult to meet the requirements of more traditional research models. Moreover, some of the data that I had access to as a headteacher, for example performance management data, was collected for other purposes and not that of research. Even if I did not use this knowledge explicitly, I still knew it and it could impact upon my way of looking at people and contexts. Additionally, I have known my fellow headteacher colleagues for some time, and information I have acquired about them and their schools will undoubtedly affect my interpretation of events. During this period of time I have also gleaned knowledge of their systems, idiosyncrasies and power relationships during interviews. Despite vowing to myself that this would not affect my interpretation of transcripts, I nevertheless know that, at times, I had too much information about internal affairs and I struggled to leave this knowledge on one side.

3.16 Data analysis

Analysing data for content and process was not an easy task. I discovered that it was difficult to separate the two and that they needed to be seen in terms of the conditions in which we were operating. I used Corbin and Strauss's (2008) 'Grounded Theory' method as a means of data analysis (p.88). The conceptual names on their 'Conditional/Consequential matrix' (p.94) provided me with a starting point for managing the data. Analysing 'process' required a different set of strategies. I was trying to capture the ongoing interaction of the sessions: the different problems, responses, situations and events. It was only when I began to see the connections between process and analysis that I noticed the harmony between questions and responses. Context and process were related because of the manner in which set members responded to the issues that were presented and because, to achieve a resolution and help the presenter, they needed to act together. In order to make sense of the transcripts I began by using the theories developed by Skemp (1989) on instrumental and relational understanding

and Shulman's (1986) concept of pedagogical knowledge and looked to see how these categories might be developed in the analysis.

A researcher can never begin with a completely clean sheet and making use of prior theorisation is almost inevitable as one assimilates and brings to bear all known knowledge on a case. Previous reading, personal experience and conversations at academic and professional practice level shape perceptions and ideas that bind any research project; they are part of the researcher's ontological persona. There is however a danger in the analysis of Set One, that because the theories adopted are points of departure rather than original, that there might be a propensity to seek a 'fit' rather than dispassionately analyse. Vaughan (2005) argues that it is possible to avoid this 'theoretical fix' or bias (p.196) by 'making theoretical notions explicit from the beginning' (p.196). Using existing theories, models and concepts as sensitising devices, she argues, is perfectly plausible provided one recognises this element of bias at the outset and before adopting a theoretical position. Ragin (2005) concurs with this, claiming that it is impossible to do research in a 'conceptual vacuum' (p.216) and that ideas and evidence are 'mutually dependent' (p.217). It appears that the theories that we select to interpret data, paradoxically, are conditioned by the information we choose to interpret.

In my Critical Analytical Study I drew on social and psychological theory to demonstrate how teachers act and react in the way that they do in the classroom and in their professional lives beyond the act of teaching. In making use of the theories of, for example, Foucault, I began to recognise how issues of power permeate dialogue and discussion at all levels. Whilst Foucault sees power as ubiquitous and beyond structure Bourdieu sees power as culturally and symbolically created and legitimised through the interplay of agency and structure. I have used this information to analyse power relations in Set One. In applying Bourdieu's theory of field and habitus (1977), as cited in Richardson, (1986), I also understand that I have acquired an analytical tool that allows me to analyse how I changed the ground rules of engagement for the Hawksridge senior managers in Set One and deliberately presented them with new challenges. I have also come to realise that Bourdieu's

theory might be further used to develop a greater understanding of how power works in schools such as Hawksridge and in action learning set two.

3.17 Conclusions for the reconnaissance period

I now know that establishing a theoretical position early on in research is crucial because it means that other elements fall more readily into place. ‘Putting the cart before the horse’ meant, for example, that I struggled to justify my role as an observer rather than a facilitator. It also meant that I was initially unsure what types of validity were appropriate because I could not see how reliable they might be. When I began the action learning process with Set One, I also thought that I was very clear about the procedures, how the set would work, how I would collect the data and where the set would meet. I discovered that plans are easily thwarted by events. The myriad meetings that headteachers and their senior managers were required to attend meant it was often difficult to pin down dates, even when they were fixed at previous meetings. I learned to be flexible during this early reconnaissance period as I found that plans conceived on paper about how the set might work were not always born out by reality.

In the next chapter I claim that there are different types of open-ended questions and that some are more effective than others in eliciting teacher reflection.

Chapter 4

Units of analysis and the development of questioning styles

In this chapter I investigate why some types of questions appear to be more effective than others at eliciting reflective answers, and how some questions require teachers to draw on a greater knowledge base than others. I discover that it is not just the presenters who are required to draw on their knowledge base but also the questioners themselves, and so I begin to pay more attention to stacks of questions. I find that it is the analysis of questions that helps me to understand the reflective process in greater depth.

4.1 Coding the transcriptions

One of the problems with qualitative research is that it is difficult to codify transcripts consistently over a period of time. This is due, in part, to my habit of continuously reading research papers where new ideas float to the surface and in part to my changing perspective over time. I developed a set of codes, which initially seemed to be adequate, and then as I read and re-read the transcripts, I found them to be inadequate. My first codes focused too strongly on the processes of learning. I initially used Skemp's (1989) work on relational and instrumental understanding to develop broad categories within the transcripts, and then realised that this only worked for the presenter's answers to the questions. I developed a further category of question types, for example, orientating (OQ), theoretical (TQ), practical (PQ), leading (LQ) and guiding/enabling (GEQ) and initially used NVivo to track them in the transcripts. I termed these question types 'surface questions' because whilst they could at their simplest level promote reflection on action, I was equally interested in whether or not they could help teachers develop deeper, reflective thought processes, and develop their level of mental models into why and how children learn mathematical skills and knowledge.

Strictly speaking, guiding and enabling questions should not be allowed in action learning (Brockbank & McGill, 2004), but I was looking for a model that worked in a particular context and I was not particularly interested in abiding by the rules if they could not deliver an effective working model. I saw the principles as set out by Brockbank and McGill as

guidelines and I was prepared to test the model as originally conceived by them. For example, I found that orientating questions sensitised the group to the situation under discussion:

‘Can you explain a little bit more about the sort of work you did before you tackled patterning?’ (OQ)

and

‘Can you tell us a bit more about how you’re going to start that off?’ (OQ)

I had originally decided that theoretical questions should be linked to learning theory but then had doubts about this, mostly because I was not comfortable with making a mental model link if the set member had not done so.

I remembered Skemp’s (1989) maxim that “there is nothing so practical as a good theory” (p.27) and that “the distinction between a theory and a common-sense mental model is one of degree rather than kind: namely its degree of abstractness and generality” (p.45). After the first trawl through the transcriptions, looking for evidence of learning theory, I came to the conclusion that this was stretching a category too far. Most of the dialogue fell into the category of the common sense mental model (CSMM) rather than theory. For example, ‘How are you going to help children make those connections?’ became a CSMM question on the second trawl through the transcripts.

Guiding questions were somewhat easier to categorise. They often pushed the dialogue in a particular direction in response to a word or phrase that the presenter used. For example:

T: Well it’s trying to link the different units together ... so maybe it’s ... well today we’re going to do this ... if it unfolds, because now I’m looking at different ways of doing the planning. So maybe that will take them away from the three-part lessons a bit because ... of the way that the activities ... hmmm are done ... you couldn’t actually do a three-part lesson.

A: What do you think could give them the confidence to move away from the three-part lesson? (*Guiding Question*)

In this section of the transcript, A has continued a theme. She has listened carefully and reflected on the previous response before asking a guiding question. It is guiding because it pushes T (the presenter) to consider an emotional response to the dilemma of two underperforming teachers.

My analysis shows that guiding questions sometimes followed leading questions, capitalising on another set member's train of thought. Although leading questions were technically not allowed either, in practice, once they were out in the open, set members found it hard to disregard them, not least as they sometimes moved the conversation along. Leading questions were usually spotted by the facilitator. Initially they were frequent in number but as the set became more proficient, they gradually declined.

D: What vocabulary games could you incorporate into your maths lessons that might help them to explore this idea of difference?

J1: Leading question

R: That's a lovely idea ... I'll think about that (*lots of laughter*).

Enabling questions (EQ) usually asked the presenter to move from description about what action had happened to where the action might go next. Presenters invariably had to draw on many of their teacher skills to answer these questions and they were not always easy to answer:

'So where do you think you're going to take it from there?' (EQ)

was a typical enabling question. Enabling questions often caused the greatest difficulty for presenters.

I decided that practical questions (PQ) should focus on teacher activities or child/learner activities. These questions were not as difficult to spot in the transcripts but there were still the borderline questions. For example, I considered this first example to be a question that related to practical activity:

Example 1: Could you give us an example of what she said to justify how she'd thought she'd done it? (PQ)

But I struggled to categorise many questions because I had not defined my boundaries clearly:

Example 2: What would be your criteria for putting them in key stages?

I originally thought this was an orientating question but then considered it might be a practical question because it referred to teacher organisation. I then realised I needed to define my categories rather more carefully before I continued. *Table 4.1* shows how I redefined my question categories.

Table 4.1: Different types of questions

Type of surface question	Description
Orientating	Questions that ask for background information about how the issue arose.
Common sense mental model	Questions which link to teachers understanding of knowledge structures based on their prior experience and learning.
Practical questions	Questions that refer to teacher planning, lesson organisation, use of resources and assessment strategies.
Guiding questions	Pushes the dialogue in a particular direction in response to something the presenter has said.
Enabling	A question that demands reflection.
Leading	Deliberately introduces a new idea to the presenter.

Although this was a useful start, it did not help me begin to answer my research questions and I needed to develop other descriptive codes. I had to classify in more depth if I wished to identify instances where set members made use of their pedagogical content knowledge (PCK), their subject content knowledge (SCK) and their curriculum content knowledge (CCK) (Rowland *et al.*, 2009).

I found it was not easy to disentangle subject knowledge from content and pedagogical knowledge, and I was forced to make a clear distinction in my mind early on in the analysis as to what I understood by these terms. Initially I had considered the Williams Report's (2008) 'Features of effective pedagogy' useful:

"Pedagogy is much more than teaching methods. [It] encompasses both classroom practice and the teacher's knowledge and beliefs about the subject and the teaching and learning that underpin it." (para. 168, p.61)

but now it was too all encompassing: I needed to narrow it down. Ball *et al.*'s study (2008), based on Shulman's work (1986), offered clearer direction for analysis.

Figure 4.1 shows Shulman's (1987) seven major categories of teacher knowledge, which Ball *et al.* (2008) elaborated on, in an attempt to narrow down and reframe the concept of pedagogical content knowledge.

- General pedagogical knowledge, with special reference to those broad principles and strategies of classroom management and organization that appear to transcend subject matter.
- Knowledge of learners and their characteristics.
- Knowledge of educational contexts, ranging from workings of the group or classroom, the governance and financing of school districts, to the character of communities and cultures.
- Knowledge of educational ends, purposes, and values, and their philosophical and historical grounds.
- Content knowledge
- Curriculum knowledge, with particular grasp of the materials and programs that serve as ‘tools of the trade’ for teachers.
- Pedagogical content knowledge, that special amalgam of content and pedagogy that is uniquely the province of teachers, their own special form of understanding.

Figure 4.1: Shulman's (1987) major categories of teacher knowledge, p.8: in Ball et al., 2008, p.391.

I also found the distinctions in the Knowledge Quartet (Rowland *et al.*, 2009) a useful guide. I added my own interpretation of what I meant by ‘curriculum and national strategy’ definitions based on experience in the field. *Table 4.2* shows the final definitions for coding my transcripts.

The categories draw on Shulman's work (1986; 1987) and Ball *et al.* (2008). Shulman's definition of pedagogical content knowledge and curricular knowledge provided a starting point for pinpointing teacher knowledge whilst Ball *et al.*'s. 2008 study clarified particular aspects of pedagogical knowledge. For the purposes of this study I have been forced to be precise about what I mean by curricular knowledge because it overlaps with specific knowledge of the national strategy. I have therefore narrowed down the definition to mean solely knowledge of the English mathematics national curriculum, because I have found that teachers use this knowledge in different ways and for different purposes. Whilst I have made use of Shulman (1986) and Ball *et al.*'s. work, (2008) when undertaking the task of analysis, I have added elements, which serve to remind me what this looks like in the classroom. In addition to these categories, I created a fifth, National Strategy knowledge. This was because it became evident, as I read and re-read the transcripts, that the language that teachers used

was often focused on the national strategy and its particular demands in terms of organisation and styles of teaching.

Table 4.2: Showing how the different types of subject knowledge have been disentangled in the transcriptions.

Categories	Description
Common content knowledge	Knowledge of the procedures of computation i.e. 25×37 (Hill & Ball, 2004).
Specialised content knowledge	Being able to explain why procedures work and which are generalisable to other problems. This refers to the mathematical reasoning and insight crucial to teaching (Ball <i>et al.</i> 2008).
Curriculum knowledge (Shulman, 1986)	Knowledge of the content of the national curriculum and the levels and sub-levels in the key stages.
National Strategy knowledge	Practitioner knowledge of specific elements of the English national strategy: i.e. the three-part lesson / chunking / partitioning.
Pedagogical content knowledge	Knowledge of the craft of teaching, the way in which ‘teachers transform their knowledge into a form that makes it accessible for learners’ (Rowland <i>et al.</i> p.21). It encompasses knowledge of content and students (KCS) and knowledge of content and teaching (KCT) (Ball <i>et al.</i> (2008). It includes methods of instruction, organisation and use of assessment and knowledge of learners.

These categories ensured I was more firmly focused on my research questions, but I discovered that they only highlighted isolated instances in the transcripts and I was equally interested in the process and sequences in action learning. How did we arrive at the ‘lightbulb’ moments for the presenter of issues – the moment when new understanding happened? Was it the result of collaborative group questioning or some individually inspired questioning by a set member? I adopted a simple strategy: I pasted the A4 transcripts onto A3 paper and used highlighter pens to denote sequences where I perceived that either group collaboration had pushed the presenter into reflective rather than descriptive mode (yellow),

or green where the sequence showed an individual member pursuing an independent idea. I could also see from my initial coding what type of knowledge set members were drawing on in order to challenge the presenter. Gradually, I began to discern connections between the questioning and the reflections on the part of the presenter, but it was only towards the middle of my analysis that I began to see the relationships between the questioners and how they interacted to develop themes.

The debriefing interviews with presenters did not require an extension of the coding. I could see that I was using first replies to questions to build on information and making use of my subject, curriculum and content knowledge, but I became aware that I was not averse to asking leading questions in the debriefing. For example:

‘So you think memory plays a big part?’

This was not the only instance of leading questions in the debriefing and I was embarrassed with my weak interviewing skills. Likewise, when I had finished transcribing and analysing (both of which took some time), I was equally disappointed with the number of missed opportunities to challenge and promote further reflection.

4.2 The development of questioning skills: orientating

In one of my first attempts at analysis I had distinguished six different types of question: orientating, common sense mental model, practical, guiding, enabling and leading.

Orientating questions were typically used at the beginning of a meeting as the set began to focus on the presenter’s version of the issue. This early part of the session involved considerable description, as the presenter had to describe not just the issue but the circumstances in which it arose. Orientating questions were important. In one of the earliest sessions, the set launched into the issue straight away and it was only when I was debriefing the presenter that she said that she wished she’d given more context early on, because it might have affected the type and range of questions she was asked:

J1: A bit of background scenario might have helped, you know, create the scenario. I haven’t any experience outside Year 5 and I think it would have helped if I’d said this first.

I considered this to be a valid comment and whilst I did not want sessions to be just about descriptions of what had happened in a lesson, the group nevertheless needed to be better orientated in the initial part of the meeting. Examples of successful orientating questions are to be found in all of the transcripts. They set the scene and provide a jumping off point, depending on the responses, for deeper investigation.

‘Can you explain a little bit more about...’

‘I’m kind of thinking, where did this question come from?’

‘Can you tell us a bit more about how you are going to start that off?’

The amount of time the set spent orientating itself in a meeting seemed to be directly related to the amount of detail provided by the presenter. In the third session, the presenter gave a very cursory presentation:

J3: OK. This is one of our pupils who came to me with this and said, “I can do short division, I want to learn that chunking thing now please”. What do you want me to say now, that’s the issue? What do you want to ask me?

On the recording there is a considerable silence, whilst the set members try to work out what the presenter is asking them to consider. They cannot orientate themselves to the situation from this small amount of information. First of all they ask for more details about the child’s question:

‘So what did you do when she said that?’

‘Could you give us an example of what she said?’

‘It might be useful for us to know why she thinks she’s confident with short division?’

And then they try to find out what the presenter had done with the child in order to ‘chase down’ the nub of the issue. They continue to ask for description until the presenter begins to think about the child more holistically and then they begin to ask more challenging questions:

‘But what would you do? How would you take that onwards?’

‘How deep do you think her understanding of place value is?’

Orientating questions seem to be a vital part of a successful session. They set the scene and help to familiarise the group towards the issue. They also help the set to think more cohesively and to grasp the essentials of a situation that is unfamiliar to them.

4.2.1 Common sense mental model questions

One of my original categories for analysing questions had focused on questions relating to theory. This did not prove successful, and it was only when I returned to read Skemp's (1989) work on the difference between 'common sense mental models' and theories that I began to make a little more sense of some of the questions. It was rare to find an example of a common sense mental model in the transcripts: it seems that teachers rarely make use of them in 'teacher-talk'. I could see that they were making connections with curricular, subject, national strategy and national curriculum knowledge through their questioning, but I could not see how they were using mental models of how children learned the mathematical concepts. Some questions touched on these common sense mental models but the presenters never fully responded:

R: Can you tell me more about what their understanding of a pattern is?

Z: Well, we haven't said 'pattern', we've looked at multiples and ... but we haven't touched on pattern yet. I haven't used the word pattern with them. I've said more of what can they see, what can they notice?

Whenever a question was asked that touched on a common sense mental model, the presenter immediately gave practical examples. Later on in the same session, a set member pushed the common sense mental model again:

E: Tell us more about the learning styles of the children in your class?

Z: The kinaesthetic was the colouring in and the talking amongst themselves, the auditory. I'm trying to think what the other was.

It appears that Z is trying to make sense of the past by drawing on what she knows to consider the question. In Skemp's terms (p.52) she is using a mental model: what she knows of learning styles and trying to recognise where this new experience fits in. She appears to have some understanding of the literature of different learning styles but is unable to use this information to reflect further. Unfortunately, it appeared that the set did not have any further information on learning styles either, because the conversation returned to the issue of mathematical patterns.

Near the end of this session a set member returned to a common sense mental model:

E: If you ... Oh no that's a leading question ... oh help, I can't think how to say it ... tell me how you think the children in your class make connections?

Z: Oh gosh ... I don't know how to answer that question. ... At the moment I think they find it difficult to make connections. I don't think ... from what I've seen of them so far ... ermm, they are not very independent and can't ... ermmm go off and make connections themselves. They can't take it from the group work and do it themselves ... to be honest.

Once again, this thread of conversation was not pursued. Another set member commented that there seemed to be multiple issues, not just one issue, and she referred back to an earlier part of the dialogue about collaboration and followed this theme so the moment to explore this common sense mental model was lost. It appears that in thinking and talking about their practice, teachers are often reluctant to move beyond the practical.

In the final meeting of Set One, the issue was presented by one of the headteachers who was attempting to develop 'lines of mathematical development' with her staff and was unsure of her progress. There are missed opportunities in this session to discuss schema construction and common sense mental models:

P: But what we hope for is that children get a better understanding of ... (*unclear dialogue*) and make connections because we think that there are children who are not making connections.

J1: You've just mentioned connections and links because we know that children understand more clearly when they make connections and links. How are you going to help children to make those connections?

P: We're hoping there's going to be a lot more practical play-based activities that are actually hung around every day, like the one thing we notice about our children is they're good at the mechanics of maths, that's easy, but if you give them a whole page of adding, once you show them how to do it they can do it, hmmm and subtract or whatever. ... But ask them to apply it ... they can't. And that's because they can't make the links. We're hoping to give them a wealth of experience and then they can make the links, also understand where they're going.

P's common sense mental model is interesting. She understands that the first mode of building knowledge structures is direct experience, and she also instinctively knows that a second mode is social. If she wants her pupils to hold discussions and share knowledge, then she needs to persuade her staff that this is a viable way of working. (This was, in fact, one of her declared reasons for wanting to join the action learning set.) P put this point to the set:

P: And what I'm first of all going to do is get my staff to make the links, before I can help the children to make them. And that's the hard bit and so until the staff understand how to make links is what I'm hoping for, that by choosing one conceptual understanding and going through the process of making the journey of how links can be made, that staff will understand the process...

Unfortunately for P the set did not help her at this point, and this included her own coordinator. The set began to ask her questions about practical support for staff who found her ideas difficult, how she might use the new assessment procedures (P skirted this issue), and how she might counteract poor teacher knowledge as outlined by the Williams Review. Her conceptual ideas and mental model were not really challenged. It was not clear whether this was because of a lack of understanding of her issue or whether it was beyond the capacity of Set One as a group. It was only near the end of the session that J2 made a comment showing she understood what had been said:

J2: It keeps coming back to what you said before, teacher knowledge and what they know about teaching. It's teacher knowledge about maths and fundamentals of how to teach it.

My research diary (p.173) noted that I considered this to be a session of missed opportunities and I was frustrated at not being able to be a part of the conversation. I was, however, able to follow up some issues in the subsequent debrief:

'What does P mean by the learning journey? (linear or hierarchical or something else?)'
'How is P going to develop reflective practitioners?'

P's debrief was different from the other headteachers. This was because the presentation of her issue was the last one for the set and also because she had insisted that action learning should start in her school in the summer term. She had reflected on her own journey as part of the set and as a presenter of an issue:

P: It made me, ... I think, ...when I think back to what we did in those early sessions, and especially the journey that I've been on ... especially those early sessions when we didn't always know what we were doing.

P's own common sense mental model seemed to combine effectively with action learning techniques. She said in her debrief that:

'It started us on a different way of talking to each other.'

and

‘I think we began to really listen to the dilemma, really think about what it is that this person can’t move forward on. I think we did make progress as a group, particularly in questioning and conquering our fears ... you know ... putting ourselves on the line.’

P’s common sense mental model of a ‘learning journey’ fits Skemp’s (1989) model of intelligent learning for schema construction. Although Skemp (1989) is referring to children’s learning, P believes that her staff have to make this journey before they can effectively teach it. She explored her own common sense mental model with the set whilst at the same time making good use of the techniques and procedures to build capacity in her own staff:

‘Paul’s pretty good at maths and he thought he had the answer to a question and Angela turned around and they’re both having a ‘da dad-a da’ and he said, “God I wish I could tape that, cos you’re challenging me ... you’re all challenging each other ... you’re not accepting what someone says.” From the staff’s point of view ... we’re not ... we’re ... we’re not comfortable yet, but we’re prepared to do internal challenge.’

My research diary (p.173) noted that only once did the set push P to explain her mental model and she fell back on practical information. They questioned her about practical issues but failed to engage her in constructive debate about how children learn new concepts. I could not decide whether this was because the set did not understand what she was trying to do or whether issues of power were coming into play. P is a well known, respected and confident headteacher in the local authority and other less experienced, less confident set members may have felt they could not ‘push’ the conversation. This issue of power is a thread that runs implicitly throughout the transcripts. My readings on action research and power suggest that the micro-politics of power is not just about authority or influence, it is also about collaboration and cooperation (Eilertsen *et al.*, 2008). In Set One, power and control resided in the ownership of issues, levels of support for each other and empowerment through dynamic interaction. Attempts by set members to direct, guide, lead and monopolise the conversations may also be seen as expressions of power and authority.

A is also a headteacher and equally well known in the local authority. She was not afraid to push P a little bit further in the conversation:

A: Obviously all staff learn differently just as all children do and some staff will be very open to all of this and they'll get the model and they'll ... (*unclear text*) straight away. How are you going to counteract the staff that totally don't get it and need something solid?

As a listener, I did not feel that the set were really helping P a great deal. In the debrief, however, she felt that it had been a useful session because it allowed her to explore her mental model of mathematical learning that she was trying to present to the staff:

P: It's given us a format for discussion ... it's OK not to have the answer ... it's OK to go and talk to someone about a problem. ... And it's a bit like a lightbulb going on when you're going through that talking process.

P's debrief emphasized that although in thinking and talking about their practice most teachers are reluctant to go beyond the practical, a mathematical action learning set can provoke teachers to deeper thinking, and that this potential deeper thinking may result in enhanced pedagogic knowledge. Transcribing this session after the debrief offered me my own opportunities to reflect on my capacity as a researcher; not only had the set missed opportunities to explore P's common sense mental model but equally I had missed plenty of my own, because I was not skilled enough as a listener to pick up on all of the elements underlying the dialogue. I also realised that the three less experienced members of the set were uncharacteristically quiet during this session, and that it was the three headteachers and the Hawksridge mathematics coordinator that had made most of the contributions.

4.2.2 Practical questions

Practical questions appear to draw on the pedagogic base of teaching. They are the decisions teachers make when planning a lesson or series of lessons: how to organise the class, what resources to use, what form the lesson will take, how they will present the information so that learners may begin to understand the mathematical concepts, what questions they will ask and what kind of dialogue is it appropriate to use? These practical elements, however, are only a fraction of the pedagogic base. The skilled classroom teacher must also appreciate children's mathematical reasoning, understand the connections between mathematical ideas and procedures, and be able to explain how these procedures work.

Using Star's (2005) theory that different types of knowledge can have a superficial or deep quality, I have categorised practical questions as the first part of the pedagogic base and put them under 'surface questions'. This is because they neither require teachers to engage in the higher order skills of synthesis or analysis, nor do they involve the skills of "comprehension, flexibility [or] critical judgement" (Star, 2005, p.408). The responses to practical questions usually resulted in description rather than reflection:

E: Tell me about the practical activities that you do with shape and patterns?

Z: What ... or the multiples?

E: Yes

Z: We've been doing the 'stand-up, sit-down' activities for multiples, we played on the board, like which multiple does the number belong to, we've done that a lot, umm and also colouring in the number squares as a whole class and then individually.

Z drew on her curricular content knowledge to answer the question. She had tried numerous ways to present multiples but her class still did not understand. Set One nudged her thinking by picking up on her use of the word patterning and persuaded her to explore this in more depth. They tried a leading question (not allowed by the facilitator) and then used a mixture of guiding and enabling questions to drill down a bit further.

In the second session R asked J3:

R: How does she think chunking will help her to become a better mathematician?

J3: That's a good question.

A: Maybe she is a good mathematician?

D: So did you start chunking with her?

These practical questions drew on national strategy knowledge and immediately pushed J3 into a description of what she did next:

J3: What I did, I talked to her about division and she has a sort of concept about that and then I got out nine counters and said, "What's the question asking, show me visually what the question's asking you?"

These questions and answers expose the type of mathematical knowledge that teachers use on a daily basis. Mathematical vocabulary such as 'chunking' and 'partitioning' and the three-part lesson belong to the national strategy. It is interesting that not only J3 makes use of the terminology, but so do the children in her class.

In the fifth session, there was again evidence of national strategy knowledge and the practically based question immediately flowed into description:

D: You've said that they've gone back to using the three-part lesson, what was it that you suggested they might try?

T: I've talked about the lessons that worked best for them. And what lessons they've taught that they thought have gone well and what was it about those lessons and basically both of the teachers said they do a PE lesson in the morning; and so maths has moved to the afternoon, so that lesson they make it game-based.

In this session there was a large proportion of description from the presenter. It was almost as if T had to talk about what she had tried before she could think about what she might change. T seemed unable to move away from thinking about the national strategy and so Set One began to challenge what she knew about her teachers:

D: So what ... do you know what they think of the three-part lesson?

T: ... I've never said three-part lesson to them. ... Or have I? I've just talked about having the children on the carpet for about half an hour. And then they tend to rush the bookwork and maybe they could chunk things a bit.

T made considerable use of her national strategy knowledge in these sessions. She became confused when challenged to step away and took refuge in this type of knowledge, in this instance of the 'three-part lesson' and 'chunking'. In her debrief T said that the session made her think about her management style and how she coordinated mathematics in the school. My research diary (p.164) noted that T did not appear comfortable during this session. It also noted that the set members had become better at asking the open-ended questions, listening to answers and teasing out subsequent replies.

Sometimes a practical question became a stimulus for a practical area of mathematics that the presenter had not considered in sufficient depth:

R: Did you complete the problem with the apparatus?

E: Closed question.

J3: Hmm.

R: How would you know if she could see that using the apparatus was relevant to solving the problem?

J3: Hmm

D: So she couldn't see that?

J3: No, she didn't see that ... first she didn't make that connection, that's why I needed to do it, she's coming back on Friday there's some bits I need to check.

Practical questions were interesting. They primarily drew on the day-to-day issues of teaching and made use of national curriculum and national strategy knowledge. They rarely seemed to push the presenter into analytical mode; instead they frequently moved into description. This session highlights a teacher's inclination to stay with their practical knowledge unless pushed to explore boundaries. J3 is an experienced, well-qualified teacher of mathematics but she seemed reluctant to explore her practice during the session. In her debrief three days later J3 indicated that the action learning session had made her think more carefully about her work.

J3: I suddenly thought, 'Yeah, this is what I need to do, I need to be taking that time because five minutes spent reflecting is better than just rushing in'.

J3 also noted that action learning is capable of extending 'horizon knowledge' (Ball et al., 2008).

J3: We too often see learning as a neat little pigeon-hole, you know, this is what we learn in Year 4, and it gives us scope to forward and back.

Horizon knowledge is described as knowledge that spans the curriculum (Ball et al., 2008, p.403). Knowing, for example, how the mathematics taught in Year 1 relates to the mathematics taught in Year 4.

J3 had experimented with the action learning approach in the intervening three days between the session and her debrief.

J3: And I thought to myself when I'm feeding back to the teachers [*following classroom observations*] I'm going to use this approach and I saw a particularly weak bit of teaching and afterwards we were talking and normally I would have said, 'Right, you need to do A, B and C'. Whereas what I said was, 'How do you think you could have done that differently?' and it just opened up the discussion and I got a really good professional dialogue out of it.

J3 noted that action learning can be a two-way learning process. Not only was she learning how to ask better questions but she felt that she had empowered one of her own colleagues to reflect on her practice.

J3: She actually came back after lunch saying, 'And another thing I've thought of was,...', [*unclear recording*] and actually wanting to develop her practice and I'm not sure that would have been the case, you know, with the usual approach.

The debrief with J3 alerted me to the managerial dimension of action learning and its potential to professionally develop teachers. J3 used her new knowledge to develop the reflective practice of her colleagues; being a part of the Set One had alerted her to new professional opportunities. For myself, I noted that action learning sets can provoke not just teachers but managers of teachers into deeper thinking and that this can potentially result in enhanced pedagogic knowledge.

4.2.3 Enabling questions

In many ways these were the most powerful questions. They were the ones that were the most difficult for the presenters to answer and the ones which frequently made them stop, think and stumble over the answers: parts of session two indicated that some set members were beginning to understand the power of these questions (*Table 4.3*). In session six, A also demonstrated that she understood how to use the information from the presenter as a precursor to an enabling question:

- A: How are you going to be sure that you're covering all of the possibilities, all of the eventualities in the Learning Journey because learning isn't linear, its messy?
- P: But I think we need to have that single thread running through first and that's why (...*pauses*) and I think that once we've got that single thread the other (...*pauses*) branches come off it, we'll be able to hang on to it. I think that it's knowing the steps first (...*pauses*) that's what the staff don't have. But children do learn in different ways and we'll come back and we'll fit that in. (...*pause*) That's what we'll do we'll use a research team model and tease out what didn't work and what we can do but first we have to go through it. First (...*pause*) I think that's important (...*pause*) understand that thread. And I think that's the problem (...*pause*) a delivery model.

P was trying out her mental model of teaching and learning with the set but they didn't respond in kind. They moved to safe territory and asked her how this linked to the national curriculum. In her debrief P said:

'But it fits in really nicely with developing my own philosophy. I got to try out my ideas in front of a group of professionals who weren't going to have to do it. So you didn't have to think about well I do or don't want to do it, you could just think about well how will this work and what might help or hinder it.'

Not all enabling questions provoked reflective answers. Sometimes the presenter reverted to description. The most effective enabling questions seemed to be the ones that projected the

presenter into the next actions that might be taken. Questions such as, ‘What are you going to do next?’ and ‘Where do you think you can take that?’ were not easy to answer. Sometimes there was not an answer and because silences were uncomfortable, a set member often jumped into the gap:

A: You said earlier that the answer must be to tackle teacher knowledge, but it may not always be the issue for your staff so how might you identify this?

P: Ummm

Silence

D: How will you know if teachers really know what goes on in more than one year group or key stage?

D seemed to have made the question easier for P to answer and she reflected on what she thought about what good teaching should look like but did not answer the question. A, however, pursued it:

A: I don’t know what ‘[XX]’ would say but how do you think it would be for you if they revisited all that work about Piaget and Bruner again? Some real thinking courses for all of us because we’re getting a lot of ‘this is how you teach this and that’ but actually what we need to do is think again about our practice and maybe that might help you and us?

P did not really answer this. She gave the set the information that there are courses out there, but they are not generally accessible to teachers because they are on the ‘Improving Teachers’ and ‘Outstanding Teachers’ programmes. This had the effect of intentionally, or not, diverting the set from the original question and they did not return to it. It also made them indignant that the training had not been widely advertised and effectively shut down the rest of the session.

4.2.4 Guiding questions

Guiding questions appeared to push the dialogue in a particular direction in response to something the presenter said. Sometimes a guiding question capitalised on a leading question but was legitimate because it was phrased as an open-ended question. For example:

E: What do you think about their level of language skills? (*leading question.*)

Z: Maybe they’re able to understand but not verbalise it

Q: That’s a leading question, do we want to redefine or move on?

E: Is it possible that they haven’t understood that ahhh that their language isn’t yet good enough for them to understand multiples? (*closed and guiding question.*)

Q: It's a closed question.

D: Tell me more about their language skills? (*guiding question.*)

This 'stack' of questions was a hopeless case. Either Z didn't know enough or felt insecure about the development of dialogue in mathematics. She went on to describe practical activities and mentioned the word 'pattern', which was picked up by another member of the set. So a new direction was taken, which this time did engage the presenter.

Guiding questions only appeared to have value to the set if they engaged the attention and interest of the presenter. They quickly shut them down if they did not perceive their value:

Q: Is there any sort of gender based aspect to this problem?

T: Hmm I don't think so. To me, in any observations I've seen, they make the children sit for too long and then there's a lot of 'on the carpet misbehaving' and a lot of teacher modelling.

T once again took refuge in her national strategy knowledge. She referred to teacher modelling, children sitting listening to the teacher demonstrating or modelling, which is a part of the 'three-part model'.

In session six, the presenter was equally quick to shut down a guiding question that she did not want to pursue:

J1: Do you know what their expertise is like out of Early Years?

P: Expertise in Key Stage 1 is not strong.

The set, however, were persistent; they had one more try at pushing the question of 'expertise' before trying another approach. J2 is a headteacher and was not afraid to challenge the confident P:

J2: Do you know what the levels of expertise look like further up the school?

P: I know that my nursery teacher used to teach Year 5. I brought her from another school here and then there's my SENCO. I know that one of my Reception teachers first taught Year 2. Most of my Early Years teachers have taught older children and then gone down.

There was a six second silence on the tape and then Set One headed in another direction. It was not clear why they did not choose to pursue this avenue of staff expertise.

In the transcripts, guiding questions often looked as if the set were ‘fishing’ for a way forward. They were not sure of the direction to take and they also appeared to be struggling to work on the same intellectual plane. Guiding questions not only guided the presenter but they appeared to guide the rest of the set into particular themes. A particularly good example of this was session three when the issue of teaching multiples arose. The original guiding question was picked up by the rest of the set who moved into an effective ‘stack’ of guiding and enabling questions with the presenter (*Table 5.1*).

4.2.5 Leading questions

The facilitators successfully spotted most of the leading questions. The decision (after the first session) to allow some of them, because the set was struggling with the dialogue, was useful initially. But as the set gained greater expertise there were fewer leading questions. This was because the set had learned to listen to each other as well as the presenter of the issue, and had also learned to pick up on nuances in what the presenter said. For example, in session three A asked:

‘Do you think it would be useful to actually use practical materials for patterning?’

This was immediately picked up by the facilitator but the question was out in the open and was built on by other set members. It was followed up by:

‘How do you think you can bring the physical aspect into patterning?’

In session four, P made use of her pedagogical content knowledge and more specifically, her knowledge of content and teaching (KCT, Ball *et al.*, 2008) to lead R into thinking about her teacher skills.

‘How do you think you can make the link between the matching and finding the difference?’

R found this difficult to answer and retreated into the practical tasks she had set the children. Yet again a teacher seemed reluctant to move away from the practical and explore the boundaries of teacher knowledge. The set pursued the issue with:

J2: Have you ... no wait ... how have you let the children experiment with the semi-concrete way of difference?

J1: Leading question.

R: Sorry I'm not sure what you mean. Can you explain a bit more?

J2: Well using graphs and pictures. So asking questions orally about pictograms?

J1: Very leading.

R: Yeah, we've done graphs, collected information, asked questions. For example, who's got more, who's got less? They were pretty good at that but when we asked then the question using difference again, that's it ... Nothing.

These leading questions seem to be a form of coaching. R was led nicely along by J2, an experienced headteacher, who was supplementing R's national curriculum knowledge.

Leading questions were sometimes irrelevant and sometimes useful. It became the task of the facilitator to decide this, which was an extension of the original role. This is quite a good example of the set recognising that some parts of the group structure functioned better than others. Change was required if the original research questions were to stand a chance of being addressed. This new structure allowed the group to function better and it augmented the role of the facilitator.

4.2.6 Combination questions

There were some questions that did not fit comfortably into one category and they were difficult to categorise. Rather than trying to be too rigid, I used analysis sheets to look at the effects of these questions on the presenter (*Tables 4.3; 5.1; 5.2*).

4.3 Conclusion

My attempt to capture the processes and procedures of action learning through analysis of transcripts has opened my eyes to the complexity of research. As Denzin (1998) said, "clearly simplistic classifications do not work" (p.338). My analysis categories show that to understand the experience of action learning, I have had to locate it within larger events such as the national strategy, the national curriculum and the recent assessment requirements, as well as in teacher knowledge. This teacher knowledge includes the seven categories defined by Shulman (1987) the further development by Ball *et al.* (2008) and knowledge of the English National Strategy.

I am practical in what I want to accomplish in my research and so my categories reflect this need. Categories began to clarify as I read and re-read the transcripts and began to make sense of the experiences. I have also learned to be flexible – I discovered I could not be too rigid with my coding – whilst remaining true to the data. Often I have had to ‘feel my way’ through passages, asking myself key questions: ‘What is going on here?’ and ‘What are the assumptions of the participants and their knowledge levels?’ Sometimes I could not make the connections even though I was there as an observer.

In the next chapter I take this first analysis of questions and look at how the process of asking open-ended questions enables teachers to reflect on their practice. I argue that it is mainly through ‘stacks’ of sequential questions that teachers are able to reconsider their way of working. I identify the difference between shallow reflection and deep reflection.

Table 4.3: Analysis of part of session two with combination questions

A: So where are you going to take it from there?	This is an enabling question. J3 is being pushed to think beyond what she has done with the child and think about the next steps.
J3: Good question. What we did was counted how many groups of four that she had, up to 16 again. This isn't her first language. I'm going to show you what she's done. I'm going to put them into groups ...hmm mm, then we did. Oh and then she still hasn't made any connection with what she was doing with the counters and this so There was no real connection, although she knew she was chunking, she was making her groups she still didn't really know that fact at this point. She put them all into groups and she told me that she had got three left over and I said, 'Can you explain to me what you have done?' and yes, she knew the vocabulary and with some coaching and pushing she could get that. And hmm mmm we then did other numbers, using what tables she knew confidently so she knew her 2s 3s 4s and 5s so we worked with smaller numbers and groups and I left it with her and then I said, 'Instead of calling them groups we could say that we are chunking numbers, we're chunking out'. 'Ah' she said. Then that's where I've left it at this point. I haven't actually said what she's doing is incorrect but I need to see where she was first. But we could certainly revisit this and check she's got an understanding of what she's doing	J3 draws on practical activity and describes what she has done. She does not answer the question. She appears to be trying to relate what she has done and make the connection with what she thinks the child knows. I believe she is using her common content knowledge, her specialised content knowledge and her knowledge of the national strategy but it is still not enough to help her untangle the problem of when to teach chunking numbers and why.
D: Do you think she was ready to move on then?	J3 is pushed again by this enabling question. It asks her to draw on her pedagogical skills. When is it the right time to move on to the next steps? So much depends on the teacher knowledge of the child, what has gone before, what knowledge is held securely.
J3:I think she wanted to see lots of figures going down the page, and I think ... I think I will go back to her and try to ask the question that you asked before, does she think that will make her a better mathematician and try and unpick that a bit more. I think, ... I think from what she was showing me, she thinks if she has a lot of numbers coming down the page that ... that's it.	J3 thinks about the child this time and not just the mathematics.

J2: Do you think that the complicated nature of how it looked attracted her?	A guiding, possibly leading question from the set member. It is not answered by J3 because D interrupts with another question.
D: How do you think she would use this approach if you gave her a word problem?	D is asking J3 to draw on her pedagogical and specialised content knowledge. This question is difficult to categorise. It contains elements of leading since it takes the group in a new direction. It is also guiding J3 towards new ideas and implicitly asking her to link it to the discussion and it is also has enabling elements as J3 may be able to make connections between the different parts of her knowledge.
J3: I don't know 'cos she has this.....	On the audiotape J3's voice tails off. She is not sure about this step.
D: How are you going to help her develop this?	D pushes again. It is an enabling question.
J3: I don't know... if she could... Apply the numbers as such.	J3 thinks back to what she knows about the child. She draws on her pedagogic skills and appears to conclude that she does not have enough information.
R: Did you complete the problem with the apparatus?	R asks a practical question.
E: Closed Question	The facilitator is alert!
J3: Hmm	J3 does not answer. It is not clear whether she does so because it's a closed question or whether she did not complete the problem with the child.
R: How would you know if she could see that using the apparatus was relevant to solving the problem?	R tries again. This question is also difficult to categorise because it guides J3's thinking but it is also enabling because it is asking her to make a connection between her different knowledge parts.
J3: Hmm	There is a four second silence on the tape. It is not clear whether J3 is using this for thinking time. My research diary records this as an uncomfortable moment.
D: So she couldn't see that?	D pushes again with another enabling question. This is an example of an individual pushing the conversation on.
J3: No, she didn't see that ... first she didn't make that connection, that's why I needed to do it, she's coming back on Friday, there's some bits I need to check.	J3 draws on her specialised content knowledge, perhaps realising that she needs to do more preparation with this child.
A: But what would you do? How would you take that onwards?	A asks another enabling question, asking J3 to think about what she needs to do in the next session with the child.

J3: Hm.mmm	J3 possibly needs thinking time. She is being challenged quite hard about her specialised content knowledge and her pedagogical content base.
A: How deep do you think her understanding of place value is?	A picks up the baton and gives J3 a guiding question to help direct her ideas.
J3: Um.mm	J3 does not answer. It is possible that the 'Umm' is her thinking space but the set is still quite inexperienced and does not give her the thinking space.
A: If you think about the way she presented the short division to you, and the way she saw that and I'm now thinking that she has to make that leap to chunking then she's going to have to have a very secure understanding of place value.	A justifies her question about place value. It may be that she is not sure if J3 has understood her. It is not a question; it is a statement. J3 does not response on the audiotape and D jumps in with another question about different ways of teaching division, which J3 takes up. This is another missed opportunity.

Chapter 5

Working at the frontiers of questioning to support knowledge development

In this section I look at the process of action learning and how participants' levels of interaction in a group can support reflective practice. I look at how working together in a group helps set members make the most of their collective resources, and how they begin to develop the pre-requisite skills for successful action learning sessions. I argue that teachers with strong subject knowledge and several years of experience can engage at a different level from those nearer the beginning of their career. I also claim that group dynamics can exert a powerful influence on an action learning session, and I look in detail at how group coherence can develop, support or undermine new initiatives.

My original supposition, that action learning can be used to support teachers' professional development by improving their pedagogical skills, their curricular knowledge and their subject knowledge, presupposes two things. First, that the knowledge teachers need for professional development is at their fingertips and second, that they are able to engage in the skills of evaluation and reflection. I look at the knowledge that teachers use in sessions in more detail, and in particular, how they use national strategy and national curriculum knowledge.

5.1 Early attempts at open-ended questioning

It is not a simple task to ask open-ended questions for an hour in a connected way. The first two action learning sessions were characterised by silences, long pauses and disjointed questioning, as the group struggled to marshal its ideas. There were plenty of instances of:

‘I know what I want to ask but I don't know how to ask it.’

In desperation, in the third session the set agreed that if they were well and truly stuck the facilitator must decide whether or not the group could rephrase the question:

E: What do you think about their level of language skills?

Q: That's a leading question. Do we want to redefine or move on?

E: Is it possible that they haven't understood that ... ahh ... their language isn't good enough for them to understand multiples?

Q: It's a closed question.

D: Tell me more about their language skills.

This was undoubtedly not quite the spirit of the original action learning model, but Set One was an experiment and we were looking for a working model and a way forward, not perfection. That set members found open-ended questioning difficult is clear from their end-of-session questionnaire responses:

'Challenged by thinking up open-ended questions.'

'If I could think of a maths question!'

'How to ask (or not!) open-ended questions.'

'Challenged again by finding it very difficult to think up questions.'

In a headteacher debrief, a set member noted:

P: I think we struggled with the open-ended questions. It was also hard not to tell people what to do ... but I think ... yes, the questioning, and digging deep. And sometimes we struggled because we were trying to ask questions to make that person think the way we wanted them to think.

5.2 Red herrings

In my research diary (p.158), I noted my confusion about leading questions. Sometimes they were 'red herrings' and took the conversation off-track when an interesting theme was developing. D's question about assessment in session four, for example, was completely unexpected:

'How do you think you might use APP or AFL to support your work?'

At other times these questions appeared useful because the conversation seemed to be at stalemate and the group could not find a way forward. My inexperience as a researcher meant I did nothing in these situations because I could not see how to resolve this problem. As it transpired, Set One resolved it for themselves; with more experience they asked fewer leading questions.

'Red herrings', however, gave me further pause for thought:

- They stopped the group from working effectively on a theme;
- They gave the presenter a breathing space from the main issue;
- They seemed to indicate that a member of the group was trying to force an angle on a mathematical issue;
- There was possibly a hidden agenda relating to power within the group.

Thinking about red herrings alerted me to another aspect of power and how it was implicitly present. I began to realise that action learning was a powerful management tool and that hidden power could operate in different ways. Headteachers and managers could learn a great deal about the capacity of their staff, just by sitting and listening to their answers, but power was also about cooperation and collaboration and working together to achieve a resolution. Red herrings could be seen as a deliberate attempt to divert the group from the issue. They could be a result of uncertainty or disunity in Set One and/or an attempt to influence how matters ought to proceed.

5.3 A matter of experience/guessing games

Another early problem centred on less experienced members of staff trying to work out what more experienced senior managers were trying to say. In Set One there were three inexperienced managers. Whilst their inexperience did not manifest itself when asking open-ended questions, their lack of experience became evident when presenting and their frustration at not being given answers emerged in the debriefing interviews:

J1: It got frustrating. There were all these experienced teachers there and I just wanted them to tell me what to do.

and

T: ... I found it umm frustrating because obviously sometimes I wanted, ... you know ... well, the answers but when the facilitator was saying that's not an open question it's because people were trying to lead me in a particular direction and the thing that frustrated me was I probably wanted to be led ... a little bit ... because I think we all do when we're stuck with a problem we all want the solutions to try out. I got a bit frustrated with that but there were times when I sort of felt that maybe people knew the answer especially if it was a leading question and I ... ah ... umm it made me feel a little bit foolish ... does that make sense?

Despite their frustration at not being given an answer, both J1 and T were able to reflect on their practice during the action learning session and afterwards during their debrief:

T: ... you know ... the whole of the primary strategy is about ... practise, consolidate, use and apply, and I think that ... well ... I'm starting to get my own answers now.

In her debrief J1 recognised what this might mean to her classroom practice:

J1: I spend a lot of my PPA [*planning preparation and assessment*] time trawling through websites, looking at books and I cut and paste the ideas into plans, but last night I had to think about the children in my class in an intensive way, what their needs are and it's good to think hard about your children and not just about levels and targets.

V: How is the thinking different?

J1: The thinking ... It's about creating, not just using ready made plans or ideas or last year's lesson plans. You have to unpack it and make it work...

J1 is a very young member of my own senior management team and not the mathematics coordinator. She went back to her year group colleague the next day and completely rewrote the work on 'time' that she had been teaching. Her enthusiasm for action learning was palpable and she shared this information with her Hawksridge colleagues.

5.4 Cognitive, affective and behavioural aspects

Group composition is complicated because it affects both process and outcomes. The changing membership of Set One as it moved through the year meant that the values and attitudes of the group adjusted each time they met. Although the original twelve members never came together other than on the first occasion, they had all been at the original exposition. My research diary (p. 192) noted this dimension. I did not try to measure or analyse it too deeply, as I was primarily focused on the process of reflection, critical analysis and learning.

From my reading for the Critical Analytical Study I was aware that personal values can and do influence beliefs, attitudes and actions. From the transcripts I was able to recognise where some set members found an opportunity to apply a value that was of particular interest to them. Because I had known three of my own members of staff for the longest time it was

relatively easy to recognise where they allowed their own personal beliefs to try and influence the task. For example J1 asked the following questions over the six sessions:

‘What did you notice about their level of language when you’re asking them for explanations?’

and

‘Could you give us an example of what she said?’

also

‘What do the teachers say about the lessons that are not so successful?’

J1 is my literacy coordinator at Hawksridge. One of her briefs is to improve the quality of dialogue in lessons and she brought this knowledge and belief to bear on the Set One context. Although this occasionally gave us a ‘red herring’, it nevertheless brought another dimension to the discussion that helped the set advance its objectives and offered another angle for the presenter to consider.

I am sure that there were other diversions which came from set members’ varied orientations, but as I do not personally know all the Set One members very well, I could not tell when this was occurring. I have chosen to see these individual performance behaviours as actions that can help the set complete its task, because I see that they are characterised by individual accomplishment, helpfulness and honesty in my own staff. Such behaviours are critical to effective team functioning and are possibly part of a broader category of actions that can help a set to develop its objectives.

A range of attitudes was slower to emerge. Some members enjoyed the experience; others found it on different occasions frustrating, demanding, thought-provoking, and motivational (questionnaires returns). I also found that different dispositions could impact on the levels of engagement and that these could also be affected by time and place. A difficult day at work, for example, could compromise the ability to reflect in depth. A headteacher, in the warm-up game at the beginning of a session, recounted how two parents had had a violent disagreement on her site and it had taken her most of the day to deal with the aftermath. She said she felt exhausted by it and her silence during this session was noticeable.

I have come to the conclusion that Set One members involved themselves in the action learning process according to their strengths, wants and needs at the time and their attitudes related to this. P, for example, wanted a new vehicle for discussion that she could use with her staff. T wanted to share her managerial problems in a supportive environment, and A was looking for a different way to work with her staff. The degree of their involvement depended on their personal levels of self-efficacy and their attitude to risk-taking.

5.5 Riskiness

For some set members electing to present an issue was a calculated risk. It meant deviating from their current position in the set and not knowing whether or not there would be any intrinsic value in what transpired. There was also the risk of personal exposure in front of colleagues:

J1: I haven't had any experience outside Year 5 and I think it would have helped if I'd said this first.

In her questionnaire return for this session J1 indicated the uncertainty she had felt before undertaking the risk of presenting:

J1: I have allowed myself to be challenged and found that it is not as frightening as I thought.

Reading J1's return, and knowing her to be a member of my own staff, caused me to reflect on the nature of risk-taking and whether some individuals have a higher tolerance than others. I felt that J1 had engaged in intelligent risk-taking because her expected outcome, as defined by her questionnaire return, was positive and she saw the downside as limited. Hubbard (2009) says that one can have uncertainty without risk but you cannot have risk without uncertainty. J1 is able to cope with this level of uncertainty because, as a member of my senior management team, I know her to have a high level of self-efficacy. It is thought that teacher attitudes to learning are in part dependent on their level of self-efficacy (Runhaar *et al.* 2010). The higher a teacher's level of self-efficacy, the more open they are to new ideas, more willing to experiment with new methods, and more motivated to engage in professional activities. J1's experience taught me that engaging in risk-taking can be both positive and negative and it is what the individual makes of this that is the crucial factor.

Attitudes to risk-taking, however, are not only affected by previous experience and feelings, they are also related to context. J1's attitude to risk-taking was entirely different from that of J2, a headteacher in the set. J2's coordinator dropped out of the set after the first meeting and I did not have the opportunity to meet her. In J2's headteacher debrief she indicated that her coordinator's outlook was fixed and that she was not easily open to new ideas. She did not feel that the time was right to introduce action learning into her school:

‘I think they might be reluctant in front of my coordinator who's our deputy head. They might not want to show their weak areas.’

Not all risks are worthwhile. In this instance J2 believed that the risk of introducing action learning could be sabotaged by her coordinator. In this respect she was engaging in ‘Loss Aversion’ (Kahneman & Lovallo, 1993) because she favoured inaction over action. J2 had weighed up the alternatives and seemed to have concluded that the *status quo* was preferable to any alternatives.

I am aware at this point that I am indulging in the game of ‘insider/outsider’. It is highly likely that J2 was drawing on different sources of information from my own and that she was context aware. The view of her own school was based on knowledge, the specifics of the case, details and likely obstacles, whilst my view is based on different and possibly weaker sources of information.

For some individuals risk-taking in a group was preferable to risk-taking individually. I have considered the extent to which Set One could be seen to promote risk-taking in a safe environment. For some individuals (i.e. T in session five) the group provided an opportunity to share a problem and she willingly took the risk of presenting. Power dimensions also contributed to risk-taking. R was particularly silent when her headteacher, P, was presenting, and M chose not to present at all. T, on the other hand, was able to stay focused on her educational dilemma despite some red herrings from her headteacher. The relationship between J3 and A appeared to be more complex. A contributed very little when J3 presented, although this was also the session where she had had to deal with difficult parents. Overall, I do not think that Set One operated well as a risk-taking group because the evidence shows that the sessions lacked rigorous cognitive conflict (Janis, 1982). However, it did critically

test the ideas of three presenters on at least four occasions (sessions one, three, four and five), and at its best was capable of analysing and evaluating issues.

5.6 Feeling foolish and disequilibrium

I confess it had not occurred to me that set members might feel foolish; it should have done because I had spent a good deal of time engaged in this pursuit when I did not know how to rescue my school from ignominy. In my early reading and in the research proposal I had noted that action learning recognises all the domains of learning: cognitive, (knowing) conative (doing) and affective (feeling). In my desire to help teachers make use of their pedagogical skills and their subject and curriculum content knowledge, I had neglected the affective and the emotional aspect of learning.

Skemp (1989) points out that the emotions have a useful function in learning. The pleasure that J1 felt after presenting her issue on time gave her support, help at a critical point and encouragement. By contrast, T felt frustrated and foolish at her inability to move towards her goal. Learning is often a 'frontier' activity (Whitaker, 1985), and it can take place in a way in which the participants are not yet competent. In adopting the techniques of action learning, the set members were working at the frontiers of their experience in a collaborative way; they were outside their zone of comfort, and possibly competence, and they reacted in different ways according to their levels of experience. Feeling foolish and frustrated perhaps diminished T's ability to think clearly and intelligently. Skemp recognises both the power dimension and the emotive aspect:

“that questioning someone in positional authority may be experienced as stressful and that this in combination with time pressure may produce near paralysis of rational thinking accompanied by a feeling of panic.” (1989, p.200)

The essence of a community of inquiry, it seems to me, is that it should support its members by helping them learn in a secure environment, where it is acceptable to take risks and where the inexperienced can learn from the experienced. This kind of work affirms professional practice *in situ* and helps to create both individual and institutional identity. This constructivist approach acknowledges that an individual can learn new knowledge as a result of interactions within a group. Meaning comes from the sharing of knowledge and experience and doing this brings fresh insights into a teacher's work.

My research diary (p.179) noted that if I eventually wanted Hawksridge staff to take ownership of this process, then it would need to be something more than just an activity we engaged in because we thought it would be good for us professionally; it would also have to be good for us on an emotional level. I gradually came to understand that there were substantial risks involved in learning in this way and I would need to manage them carefully, so that staff remained confident and keen to continue this type of professional development.

Engaging in action research at the Set One level affected the inexperienced Hawksridge senior managers. They became more confident classroom teachers, made better use of their developing questioning skills, and became more self-assured as managers. They took a stronger lead in managing their subjects, their voices carried more authority and, as a result, their experience affected the balance of power at Hawksridge meetings. I did not see this negatively. I viewed it as a positive move forward for the school. There were however some unforeseen consequences; the use of power and control is complex and difficult to handle, especially for young inexperienced staff. J1, in particular, found herself in difficulties and her actions gave rise to new 'micro-political' (Eilertsen, 2008) complications in the school.

5.7 The skill of reflection

Attitudes to the skill of asking open-ended questions were easier to ascertain than another dimension of action learning: reflective practice. Questionnaire responses focused heavily on the skill of questioning but only a few commented on the skill of reflection:

'I have reflected on my practice and been challenged to think through a problem. I will share my reflections with my parallel teacher as a way to open a conversation about how to approach the problem.'

and

'Being challenged to reflect really makes you think about how children learn.'

A small number of set members indicated that the sessions offered them opportunities to reflect in different ways:

'On my personal teaching experience with regard to the issue presented.'

'It might help to encourage my colleagues to be more reflective.'

'I will reflect more on how children view the mathematics that they do.'

Copeland *et al.* (1993) maintain that teachers are more reflective at different depths according to the stage of their lives and professional careers. This might also be linked to the institution in which they work and the opportunities offered to them.

I also observed that reflection and anxiety can be part of the same thought process but that it does not necessarily block learning, although this only became clear to me in the analysis afterwards:

T: Do you know ... well ... by trying different things ... and if it doesn't work ... then that's OK ... because that means you're thinking, doesn't it ... because you've tried something...

D: How well do you think they would be able to try new things if they're not feeling confident?

T: I don't know...

In her debrief three days later, T said the session had made her reflect on her management style and had given the headteacher and herself plenty to think about before the next academic year started:

T: ... and I thought well right I'm going to talk about this problem and it was just something at the back of things and it was throwing up things that both Q and I need to think about...

J2 considered this to be a good session because the set had got a better grasp of open-ended questioning and also because by then everyone knew each other quite well. Interestingly, T considered the fact that we did not know each other very well to be a plus point because she could present her mathematical management issue. Both T and J2 were correct: T, because she did not know the set very well, having only attended only two other sessions, and J2 because she had attended every session.

5.8 Elements of a successful session

There were elements in each session where the dialogue appeared to flow and then sections where the set members seemed to be floundering. The fifth session appeared to be the one in which the group all felt the greatest satisfaction, although the presenter claimed that she had been metaphorically 'tossed and turned' (questionnaire returns for fifth session). Each session demonstrated some elements of success as shown in *Figure 5.1*. This did not mean that the

presenter reached a resolution of their problem but rather that the set dynamics had operated well enough to ensure a lively dialogue.

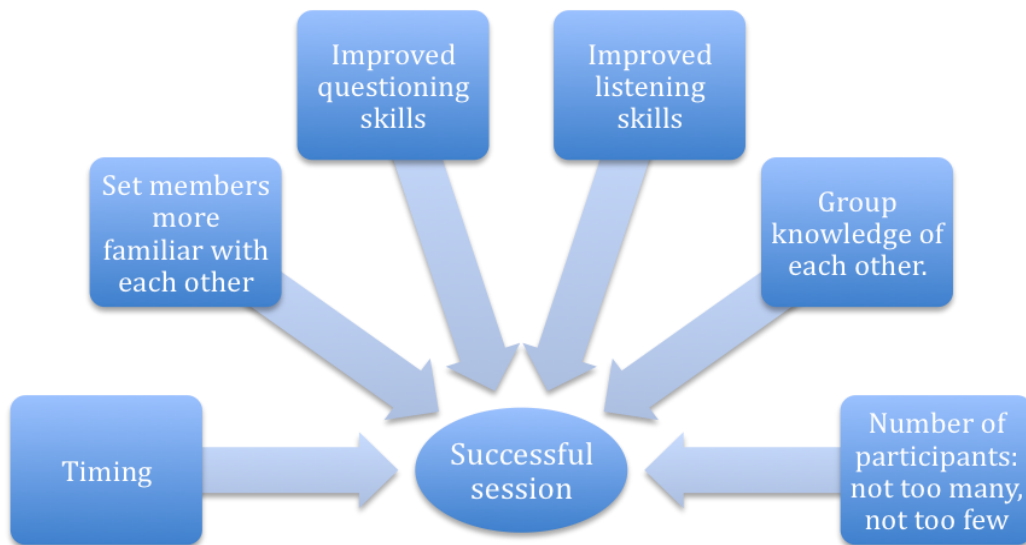


Figure 5.1: Showing characteristics of a successful session

This penultimate group (session five) was composed of experienced set members, who worked in tandem to challenge the presenter. This was a particularly hard session for the presenter, since for the first time, group members were unconsciously working together to try and get to the nub of an issue. There was not an immediate or obvious answer to the issue that T presented, but it was not until I viewed the transcript for the session that I realised that the group had moved the frontiers and collaborated in a different way. On three occasions in this session there were successful stacks of questions, which pushed and probed the presenter's thinking. This is demonstrated in *Table 5.2*, which shows part of the transcript, and analysis.

J2 was correct when she noted that as a set we were much more accomplished by the end at asking open-ended questions. This was partly because by this time I had transcribed most of the earlier sessions, and after session three had correlated a prompt sheet of starter-questions from those asked in sessions. My research diary indicated that the set rarely used these (Appendix A). They might glance at them but they did not depend on them.

The conversation from session five (*Table 5.2*) is a good example of the set working collaboratively and challenging the presenter. On this occasion they managed to work in a triad, with three set members building on each other's work to challenge the presenter. While I can find scant evidence of T using her subject knowledge to answer the questions (she was mainly focused on using her national strategy knowledge), she was forced to think about her two teachers' emotional response to lessons. She also had to reflect on different ways of teaching a lesson. In her debrief T said she felt foolish because she could not answer the questions. The set by contrast was buoyant. My research diary (p.180) records that they were 'quite bubbly' afterwards and that they felt they had improved their questioning technique. In this example (*Table 5.2*) the set had become much more skilled at 'teasing out replies'. Improved listening skills and better use of the pauses and silence meant that the presenter was forced to delve into a part of herself that she was unaccustomed to accessing. She did not find the experience comfortable at the time but reflected in her debrief that, 'I think it's something we need to get better at'.

T's session made me think about the kinds of knowledge that teachers use on a daily basis in mathematics lessons. It seems to me that whilst there is nothing wrong with using strategy knowledge, it needs to be underpinned by curriculum and subject knowledge. This type of 'strategy knowing' is fragmentary and does not help teachers to make connections in learning.

Another productive session centred on the teaching of multiples. This was characterised by a teacher confident enough to reflect aloud to the group to give herself thinking space.

Z: Oh gosh ... hmm ... well, I thought it was physical colouring it in but ... ummm ... obviously not. Err ... umm ... I've got to think, you've put me on the spot, I've got to think of what else I can do (*talking to self*).

My research diary notes that when Z was asked informally at the end of the session if she felt stressed by being 'put on the spot' by another member of the set, she said that it was hard but that she felt good about it. In the debrief, she reflected that she had totally rethought her work on multiples, and did not feel that she would have done that if she had not presented the issue to the set.

I would like to think that this is a case of action learning at its most powerful: Z was beginning to make connections across mathematical themes. But I also recognise that it was

also a question of timing – the session happened just when she happened to be really puzzled about an issue, and it also happened to a member of the set who probably already had reflective qualities. I also began to think about what it was that made some sessions more powerful than others, because not all sessions were the same in quality.

In session three Z used her strategy knowledge but she began to realise that it was not enough. She had to make the mathematical connections and think about how children learn. She was being pushed to link her strategy knowledge to other types of knowledge that she held, and through the level of challenge she was encouraged to broaden her beliefs.

5.9 Group characteristics and Set One

Part of Set One's purpose was to trial a new procedure and although its life span was short, it fulfilled this purpose. However, it did not appear to move through the four stages of growth and development that characterise a wide variety of groups in our society (Mills, 1967, cited in Luft, 1984). It ventured along some of the pathways but never fully developed them.

Set One was *adaptable* to a small extent and was able to increase its range and diversify. So, for example, it moved in the fifth and sixth sessions into a discussion of the management of mathematics. In these two sessions, the set managed to retain its rules, techniques and procedures to accommodate this new issue. The set also retained its *goal orientation* throughout its existence, and its capacity to add new goals was particularly important for Hawksridge. In terms of *integration*, Set One never split into two parts although this was a suggestion from a questionnaire filled in by a set member at the end of one of the first very large sessions ('Two sets would be better than one'. Questionnaire return, September 2008).

Set One did not admit new members (*integration*) as it went along, but one of its prime purposes of existence was to try out procedures, which could then be transmitted to another group. Set One's capacity to reformulate into two successful Set Twos (Hampton Set Two and Hawksridge Set Two) indicates that the experiences and learning that had been acquired could be successfully transferred. In this respect it fulfilled Mill's fourth requirement

Table 5.1: Analysis of part of the third session

Conversation Session 3	Analysis
<p>E: Tell us more about the learning styles of children in your class.</p>	<p>This is a guiding question. The facilitator has just disallowed a leading question on styles of learning and E has decided to make use of it. Once a leading question is on the table, the set seems to decide voluntarily that it may or may not make use of it. The set member is using her pedagogical content knowledge skills.</p>
<p>Z: The kinaesthetic was the colouring in and the talking amongst themselves, the auditory. I'm trying to think what the other was.</p>	<p>Z appears to be exploring avenues. The set is experimenting with ideas and Z may decide either to go ahead with them or discard them. Z appears to have some knowledge of learning styles so she answers using her pedagogical knowledge and adding her practical experience.</p>
<p>P: The visuals, which you've already said there was a problem with.</p>	<p>The set member helps Z out by adding more craft knowledge. It is not a question but she wants to know why visual learning is difficult for this class of children.</p>
<p>Z: I'm trying to do more practical activities which might help them.</p>	<p>Is Z being defensive? It doesn't sound as if she is from the audio recording. Her voice turns up at the end and she is almost asking a question herself. She is relying on her pedagogic skills to answer.</p>
<p>R: What tactile resources do you make use of?</p>	<p>R helps her out by using another guiding question. The set is still using its pedagogic knowledge to work this question</p>
<p>Z: Whiteboards so they can write things down, their number squares that they can colour in.</p>	<p>Z answers using practical recall of what she has already done.</p>
<p>R: I was just going to ask how much you know about their patterning?</p>	<p>Z has already mentioned patterning earlier in the conversation but the set member clearly thinks there is some more mileage in it. She is guiding Z back to the idea drawing on her specialised content knowledge. It is SCK because the set member is drawing on her knowledge of procedures and seems to be guiding Z towards appreciating that children need to have this elementary competence before they can begin to understand number sequences.</p>
<p>Z: Well we haven't said 'pattern', we've looked at multiples and ... but we haven't touched on pattern yet, I haven't used the word 'pattern' with them. I've said more of what can they see, what can they notice?</p>	<p>Z is very honest. She picks up the idea again and relates it back to her class. She is using her pedagogic knowledge to decide that her class appear either to have forgotten, do not know or have not made the mathematical connection. It is possible that Z is only just making the connection and is therefore on the brink of enhancing her specialised content knowledge and her curricular knowledge.</p>

P: How do you think it would change their knowledge of multiples if, oh sorry, that's too direct, OK if you put the multiples on hold and you focused on the patterning how do you think they would respond?	P appears to have made the connection between early patterning skills and identification of multiples. She uses this knowledge to enable Z to think about how these two might connect. She is using her specialised content knowledge and her pedagogic craft knowledge. I have termed this an enabling question because it pushes Z into thinking beyond what she has done and is asking her to analyse what might happen if she changed how she was teaching.
Z: I think it would benefit them (interrupts P). To be honest, yeah, I could change my mental starter and look at patterns and try and bring it in that way and see if it helps.	Z is animated on the audio recording. She is still using her national strategy knowledge and is clearly not quite ready to abandon it, but she is able to think about how she might integrate the new ideas.
E: If you, oh no, that's a leading question. Oh help I can't think how to say it ... Tell me, how you think the children in your class make connections?	E asks an enabling question. She is pushing Z to make the connection between patterning and multiplying. She is appears to be drawing on her pedagogical knowledge and her specialised content knowledge.
Z: Oh gosh ... I don't know how to answer that question. ... At the moment I actually think they find it difficult to make connections. ... I don't think from what I've seen of them so far ... ermm they're not very independent and can't ... ermm, go off and make connections themselves. They can't take it from the group work to do it themselves ... to be honest.	Z is in a state of disequilibrium. She now has to make the connection herself. She uses her pedagogical knowledge to acknowledge that her class is not very good at making connections, and that they are not very independent as learners. She needs to think about what this means for her teaching. The set is silent while she thinks this through. She is rescued by E who decides that she has multiple issues here and points the set in another direction. This is one of the missed opportunities for the set to really help Z think through her problem in more depth.

of *pattern maintenance and extension*. (Set One has now spawned Set Two and, more recently, Set Three, September 2010.)

Some of the participants may have learned more about their own ways of learning from the sessions. End-of-session questionnaires indicated that members had thought quite carefully about the open-ended question style of learning. The question, ‘What have you gained from the learning set today?’ elicited the following responses:

‘How to hold back from giving the answer.’
 ‘To learn ways of asking non-leading questions.’
 ‘I have thought about tackling problems in different ways.’
 ‘I will have more confidence to think through and re-do.’
 ‘I’m more reflective on how children view the maths they do.’
 ‘I have a greater understanding of open-ended questions and the results they can yield.’

From the variety of answers I began to understand that the members had come to the sessions with different needs, goals, attitudes and abilities. It became clear to me that individual dispositions were important to the smooth functioning of the set but I also began to wonder if it could contribute to the development of dispositions. This was not an area I had time to explore during the limited life of Set One, but I experimented further with this in Set Two at Hawksridge.

The responses to the final question on the questionnaire were often illuminating: ‘What could be better?’ I did not choose to act upon all of the suggestions since some were procedural but others were helpful:

‘More opportunities to facilitate.’
 ‘More people to provide a large/wider range of questions.’
 ‘If we could suggest things.’
 ‘Would have liked time to list thoughts that have arisen so I can feed back to the SLT (Senior Leadership Team).’

The overall climate of Set One remained positive throughout the year. Questionnaire returns indicated that members who attended regularly felt that it was the process that was significant and not just possible solutions:

P: Mmmm it’s the drilling down and I think that’s the bit that’s changed me.

They also appreciated the time and space to ‘step back’, observe and listen:

J3: It's like coming out into a little oasis really where you can shut the world out and think, OK we're here to talk about maths, its not often we have the luxury of talking about a subject we're passionate about with supportive colleagues, ... just a chance to talk and reflect.

This creation of dedicated time and space for the purpose of reflection and discussion is not always valued in the hurly-burly of the everyday workplace. Tett *et al.* (2007) claim that time and space should be given to all teachers in order to stimulate systematic reflection. They press for ‘collegiate spaces’ (p.44) in which teachers regularly meet to hone their reflective skills and consider their practice.

5.10 Group dynamics

Problems with group size had emerged early on. I had noted the difficulties with audio recording in the first session but there were other more subtle problems. When Set One first convened, not one member (including myself) knew everybody and this had various effects. On the one hand, there was initially a low level of trust which I think limited communication (confirmed by another member of the set in a debrief), on the other hand, one of the presenters felt able to put forward her issue precisely because she felt anonymous in the group.

In retrospect a large set appears unwieldy. In a smaller group cohesion seemed better and issues were explored in more depth as evidenced by the greater number of connected questions. By the time we reached the last two sessions, two coordinators had dropped out but the rest of the set had met regularly each half-term. One of these coordinators felt uncomfortable working in the group. In her debrief she said that:

‘We don't know each other particularly well.’

Following her presentation of the issue and subsequent debrief this coordinator dropped out of the group. In her questionnaire return at the end of the sessions that she attended, she noted that she did not like being prompted to attend the meeting in her own time.

The gradual build up of trust was pointed out by a headteacher in her debrief:

J2: I think we got to know each other by the end. It made it easier to say, ask a question.

The early criteria for membership of Set One allowed for both the headteacher and the mathematics coordinators to be present since I believed that this gave Set Twos a more favourable chance to establish themselves. However, it impacted in other ways on the quality of dialogue.

In session five the headteacher frequently interrupted the flow of questioning by adding information. For example:

- D: So has this been a continuous problem with this ...(*interrupted*)
 Q: Well it's just this cohort.
 D: So it's just this cohort, did you have this problem last year?
 Q: One did and one didn't.

At another point, for example, the headteacher commented that the two members of staff under discussion were not following the 'spirit of the behaviour policy' and at another point interjected with:

'Is there any sort of gender based aspect to this problem?'

and

'What is the quality of planning like? Are those things in place?'

In the debrief the coordinator said that she had this problem and that:

'I did it because it was a setting where I could do it and I don't ever get the opportunity to talk about that really and get lots of heads together. So it was definitely good that we don't know each other particularly well for something like that to come out so it's confidential and better.'

The coordinator also commented that it had given the headteacher and herself plenty to think about, apart from the amount of time that she had spent considering her own personal management style. This comment also made me aware of my responsibilities as an action researcher. I had no desire to impact upon their institution, and I belatedly realised that I needed to be more aware of the micro-politics involved when engaging in any type of research.

My awareness of how power relationships might constrain practice was brought sharply into focus during the session five debrief. I surmised that it was not always a positive thing to have the headteacher and coordinator present, unless the two were able to adopt a similar approach to both the process of action learning and the issue being presented.

5.11 Developing the role of the facilitator

The role of the facilitator changed in small but significant ways over the year. Initially the role was clearly prescribed but by the second session the set had already decided that sometimes a facilitator could allow a leading question. Changing the facilitator each session had mixed results. Although this permitted different members of the set the opportunity to try this role (not all managed to achieve this because of the size of the group), it also meant a relatively inexperienced facilitator was in operation at most sessions. The group debated trying one session without a facilitator but came to the conclusion that this did not work well and reverted to the use of a facilitator well before the end of the session.

Facilitators needed particularly good listening skills and the ability to concentrate on what was being asked. They needed to reflect quickly on the type of question and decide whether to allow it or not. In practice the set never challenged the facilitator, although on reflection I can see that this might happen if a facilitator was inexperienced

By the end of the last session the role of the facilitator had grown. First, they were responsible for reminding the group of the ground rules: this was important because set membership fluctuated over the year. Second, they initiated the introductory activity and its timing: truth, trauma or trivia¹ was always popular. Third, they had to decide whether to allow a question or not: questions that were closed were definitely not allowed but the facilitator could ask for these to be rephrased. Some leading questions were allowed if, in the estimation of the facilitator, they moved the conversation forward when the dialogue appeared to be stalling. Finally, the facilitator was responsible for the timing of the session; this meant not just determining the beginning and the end, but also observing participation levels and judging

¹ An introductory, warm-up activity where the facilitator asks each set member to recount an event, an incident, or something about themselves.

whether members or the presenter had reached their limits of endurance. This was not an easy task as silences could be ambiguous.

I learned from this experience that it would be better if I trained just one facilitator at Hawksridge. A skilled facilitator would, I felt, improve the flow of questions. It was an essential part of group communication that Set One, because of the way it was organised, never quite got right (Appendix F).

5.12 The power of listening

I discovered that when set members were listening carefully, not just to the presenter but also to each other, then surface and deep reflections were apparent in their questions. It took me some time to realise this. Initially I was overly focused on the reflections of the presenter, and it was not until I transcribed and started the analysis of the fourth session that it occurred to me that effective questioning required reflective skills on the part of the questioners too.

Listening, I discovered, is an active process. It requires a degree of empathy as well as the ability to acquire information. Brown and Keller (1979) (cited in Luft, 1984), claim that:

“It involves moving out of one’s own consciousness to the consciousness of the other, returning to personal thoughts and the reaching back to the other in continuing cycles.”

and that:

“Listening with appreciation is probably the most sophisticated and the most imaginative act a person performs.” (p.72)

Mindful of Jacobs and Coghlan’s (2005) contention that weak listening skills impede the opportunities to learn, I looked again at the transcripts from the angle of listening rather than speech. I discovered that when participants were actively listening to each other and not just to the presenter, there was a greater potential to generate reflection and meaning. This was particularly apparent in the fifth session where I began to see that listening is an activity itself. In this session I started to recognise the skills of attention, reflection and empathy on the parts of the listeners, and to note that effective listeners can generate meaning by building on the ideas of others.

Table 5.2 shows how set members A and D are a part of a constructive exchange; they listen to each other and T's answers to develop a sense of coherence through their collective questions that challenge T, the presenter. In her debrief T said that she felt that set members were sometimes trying to guide her. Evidence of this is shown in *Table 5.2* although she is not given any answers; she must work this out for herself.

5.13 Silence

Set members could choose to be silent in a session although none were exclusively so. Silence had different meanings according to the context. Silence from the presenter could mean several things:

- That the question was not understood;
- That the presenter needed more time to reflect on her position;
- The presenter was waiting for another set member to speak;
- The presenter did not wish to explain herself.

Silence from set members could also be situational:

- Members were listening attentively;
- Members felt under pressure;
- Members were having difficulty constructing an open-ended question;
- Members were disengaged by the process;
- The issue had run its course and there was no more mileage in the process.

For a facilitator in an action learning set, silence was unnerving and a powerful presence in meetings. This was partly because one could never be sure what type of silence it was. It was not until the penultimate session that the set began to feel comfortable with the idea of silence. I included myself in this, as I too found myself vulnerable to these early silences. I worried that the process was too difficult and that by their silence, members were opting out.

5.14 Conclusion

This kind of reflective work seems to me to affirm good professional practice. There is evidence in the transcripts that, by working alongside each other, teachers began to acquire knowledge from each other. At Hawksridge, in particular, the senior managers in Set One benefited from the new approach and practices that brought fresh insights into their work.

This is very different from understanding learning as simply the transmission of knowledge. From my constructivist perspective I see professional learning in Set One as the result of social and interactive experience. I have also discovered that reflective practice as professional development is not without its problems. Issues of power, who holds it, when it is exercised, and its impact were intrinsically a part of Set One meetings and crept unobtrusively into at least two schools, one of them being Hawksridge. My analysis shows that I not only need to understand how a group operates but also that issues of power are intrinsically bound to the group both within Set One session times and beyond.

I have learned that the level and type of participation is fundamentally important to know how well action learning sessions run: too many passive participants and a session is ineffective. At the other extreme, too many active participants, who do not listen to each other, can also be ineffective. There is a fine balance between too many and too few participants, between too much and too little experience, and between working harmoniously together and making the most of teachers' varied knowledge, which provides an action learning session with its energy.

Table 5.2: Analysis of part of session five

CONVERSATION	Analysis
D: Do you know if there are any other lessons in the week when the behaviour is better than it is in maths?	A practical question asking T to draw on her managerial knowledge of the two teachers under discussion. D probably anticipates that she will draw on her pedagogic skills of classroom organisation to answer. She fails to spot that it is a closed question and the facilitator fails to spot it too.
T: Yes!	The closed question is dealt with summarily so D tries again. On reflection it is possible that this is a two-part question because D seems to know exactly how she is going to follow it up and perhaps just wanted confirmation of her original thought.
D: So what do you think the difference might be between the ones that worked and the ones that didn't?	An enabling question. D is pushing T to make links. T needs to analyse what she thinks a good lesson should contain.
T: Ones in the afternoon. When I've said, 'which lessons work for you?' And they said when they use board games to look at these skills. I said, 'Well we can't just do board games but we can incorporate the board games aspect in a lot of the maths lessons.' But ... yes, they've identified that that is the lesson that works. But then...	T is being descriptive. She describes the conversation she held with the two teachers. She begins to make the connection and then stops. There is a pause on the tape of four seconds.
Q: Are they just playing? To what extent is personalizing the learning an issue here?	T does not get the opportunity to reflect. A 'red herring' from her headteacher about personalisation enters the conversation. The second part is open-ended so it is allowed by the facilitator but it is a leading question since personalisation had not entered the conversation previously. The red herring draws on pedagogic skills that are not necessarily related to the mathematical element of this issue.
T: Yeah ... Well ... I don't really know ... I don't think the lessons are particularly well personalized. Its good differentiation ... but I don't know if what's happened in the previous lessons ... they could be adapting their planning but I'm not monitoring them every day ... soooo that could ... be ... and it might not necessarily be written on the plan	T draws on her pedagogic skills. She considers differentiation, how the teachers might have assessed previous learning. She reflects that she does not really know because she is not there often enough and these are elements that might not be necessarily be on the mathematical daily plan. T seems to be making the connection that teachers cannot plan for every eventuality and in a lesson a multiplicity of response options could occur to which the teachers must be able to respond.
P: What kind of ways have you thought of to help develop your teachers' mathematical teaching skills?	A guiding question from P. P is guiding T towards thinking about the mathematical skills that her teachers will need to teach well. She is working with T's answer from the last question and it appears to be trying to help her develop her idea. This question causes T some difficulty.
T: That's something I want to look at, hmm ... next year. I wanted to do some pedagogy stuff but the consultant said ... but it became one of those things in the staff meeting ... the	T's answer is interesting. We never found out what the consultant said as she starts the sentence and then does not complete it. She acknowledges that this is an area that she needs to focus on next year. She mentions the time factor as an inhibitor. T does not delve into what pedagogy

time was shorter so that's something I definitely want to look at, hmmm ... But in national websites NCETM has got auditing of skills so what I'd like to do for the whole staff is do that so people can see where they are, you know ... and I'd probably have loads of gaps. But I think it would be quite a good thing to do with the whole staff. It would maybe address some of the issues.	means to her or her staff and returns to a safe base with the information that she will start with the NCETM audit.
T: Actually something else that I did do at my maths network coordinator meetings was you know the topic webs that people have done to try and link things in? I'm starting to use those a bit more. That's only just recently so maybe that ... Because sometimes I think its just ideas that they need because it's hard to generate ideas on your own.	T is still on the trail of pedagogy but beginning to think about subject knowledge. She recalls some work on topic webs that might be useful but does not explain how she might develop this with her staff. She acknowledges that collaborative practice is a good way forward.
D: That's the creative part of learning. How do you think you might develop that?	D builds on T's theme. She asks an enabling question. The set is working well together. Listening skills appear good and they are building up themes. T, D and P are working well in tandem.
T: Well it's trying to link the different units together ... So maybe it's well today we're going to do this ... if it unfolds, because now I'm looking at different ways of doing the planning. So maybe that will take them away from the three-part lesson a bit because ... of the way that the activities ... hmm ... are done ... you couldn't actually do a three-part lesson.	T falls back on her knowledge of the national strategy and planning. She is not sure of herself. The audio recording has five short pauses and the set for once makes use of them. T has to talk this one through.
A: What do you think could give them the confidence to move away from the three-part lesson?	A continues the theme. She has listened carefully and reflected on T's response before asking a guiding question. It is guiding because it pushes T to consider an emotional response to the dilemma of the underperforming teachers.
T: Having successful lessons that don't involve board games. That's the successful lesson but they can't have board games in every lesson. So I think for them to have some successful lessons that are just a bit different.	T has a practical answer, but has begun to think about what success might mean.
D: How are you going to help them do that?	D does not let T have an easy time. This enabling question challenges T to think in greater depth about what this might mean.
T: Do you know ... well ... by trying different things ... and if it doesn't work ... then that's OK ... because that means you're thinking doesn't it ... because you've tried something.	T stumbles in her answering. Her answer has six short pauses and once again the set uses the pauses. T seems to struggle to find a response. She is beginning to reflect on why teachers need to find different ways of teaching mathematical knowledge
A: How well do you think they would be able try new things if they're not feeling confident?	A works with D to push the emotional aspect of teaching. This is an enabling question.
T: ... I don't know...	T is really very unsure about how to answer this.

Chapter 6

Using theory to make sense of action learning

In this chapter I show how I have used theory to try and understand what happened in action learning Set One. Bourdieu's (1977) notion of habitus and field enables me to make sense of my position as an insider researcher, whilst Luft's (1984) theory of group learning helps me to understand why some set members found action learning supportive, although others discovered that the experience could not meet their needs. Engeström's (2001) activity theory allows me to locate my thoughts on how knowledge is generated and consider how a wide range of factors can work together to create new knowledge. It also helps me to understand how different types of theory complement and interact in a teacher's professional development. Finally, I return to the work of Vygotsky (1986) and Habermas (1971), trying to locate the language and discourse of Set One within these theories.

Without theory it is difficult to critically analyse the work of Set One. In trying to make sense of what has been happening, I have had to return to my work in the Critical Analytical Study to remind myself about what I discovered about learning theory, social theory, psychological theory and the socio-cultural approach. This is because Set One operated within more than one sphere, and to use only one theoretical approach seems to me to present only one part of the picture. I argue that theory gives substance to the process of action learning; it supplies the building blocks and the structure. It guides the way forward for Hawksridge because I can begin to see how I must manage the whole field rather than just pay attention to the development of mathematical knowledge and skills.

6.1 Understanding the insider self using Bourdieu's notion of field and habitus

I have found Bourdieu's (1977) notion of habitus and field to be a useful way of looking at my internal and external manoeuvring for whole school change, and a means of reconciling my own perspective as an insider researcher and a manager within the same field.

By habitus Bourdieu means a system of dispositions that an individual possesses; these might be seen as perceptions, thoughts and actions connected to schemata. An individual develops

these dispositions in response to the conditions they meet but they develop below the level of consciousness. This ensures recognition of a situation without implying knowledge of the distinctive features that define it. In this way, Bourdieu believes that the social structures an individual encounters converge into a personal set of dispositions, which then correspond to the structures and needs of the social field.

The 'field' Bourdieu defines as a structured social space with its own rules, schemes of domination and power. Bourdieu sees fields as relatively autonomous from the wider social structure in which people relate through a complex system of social relations. He cites education, law, politics and the economy as examples of 'fields'. Organisations, he claims, such as voluntary associations must also be understood as fields with their own stakes to be struggled for and not as systemic structures (Bourdieu & Wacquant, 1992, cited in Naidoo, 2004, p.460).

Bourdieu shows how the social structure of fields can constrain change. He maintains that the 'social subjects comprehend the world that comprehends them' and he demonstrates how through the 'differentiated and differing conditions of existence, through exclusion and inclusion' the social order is progressively inscribed in people's minds (Bourdieu, 1984, translated by Nice, 1984). An example of this might be students going to university to study for a degree. Early on in their secondary education, students who wish to be a part of the field develop a feel for this social situation; they begin to understand what the good moves and bad moves are: for example, completing assignments on time, studying for exams and they develop the skills to play the game intuitively. They learn that through the skills of language, through judgements, verdicts of teachers and assessors, gradings and warnings what they must do to be a part of this field; to not comply means possible social exclusion from the field. Bourdieu terms these 'field specific' resources as 'capital' and the type of capital operating in higher education as academic capital.

Bourdieu's theory of field might also be used to understand the way that power works within educational institutions. The desire to be a part of a field does not necessarily assume admittance. During the time Set One was in existence a young colleague was casually discussing her child's GCSE choices. She was keen for her to enter a good university in the future and was beginning to explore possibilities. What she did not know was that the subjects

her child had selected for GCSE would constrain her choice. This young, ambitious member of staff did not at the right time possess the crucial knowledge to determine her child's future. She did not, in Bourdieu's terms, possess the academic or social capital that would have enabled her child to be a part of the elite educational field. (Social capital is a resource that is connected to group membership and social networks.) This example highlights the value of social relations and how social capital can be used to produce and reproduce inequality in schools; guided by different information the young member of staff proceeded to remedy the situation.

I perceive Set One as the 'field', and it represents the social space where I manoeuvre and struggle to acquire the desirable resources for my school. By participating in this field, and encouraging my senior staff to be a part of it, I am investing in myself and my senior leadership team the 'know-how' that will allow us all to be a part of the same field, and thus begin to create an institutional identity from the fractured parts of our school. There are however, two sides to this coin, I have destabilised the field by changing the rules and challenging the habitus of my senior management team and I have also potentially allowed *them* to destabilise the field by encouraging such challenging behaviour.

In Set One members of my senior management team have been exposed to a new way of thinking and working over a significant period of time; in effect I was repositioning them with unknown consequences; in retrospect a high risk strategy. Bourdieu's (1977) exposition of these hidden forces, which can impact on a teacher's identity, allows me to see that I have been engaging in a powerful conditioning exercise. The professional identity of my senior management team has been pushed into an artificial social landscape that I have created.

I have not created this landscape haphazardly. There were structures and procedures that we followed in Set One, and all of this work has been carefully analysed so that Hawksridge can make use of the information. Set One might have experimented with action learning techniques in order that Hawksridge might benefit, but additionally there were benefits for the set members as defined by their debriefs and questionnaire returns (*Figure 6.1*).

Figure 6.1 was constructed from the debrief transcripts and the end of session questionnaire returns. It summarises the thoughts and ideas of individual set members and indicates that

there are both tangible and intangible outcomes from participating in a set such as Set One. There may also, I acknowledge, have been hidden consequences of participating in Set One and one of these relates to issues of power. J1 for example, found herself in difficulties, possibly as a result of membership of Set One although other power issues in Hawksridge cannot be discounted.

Beneficiaries	Benefits for participants in action learning
Benefits to Organisation	Arena for problem solving. Quick answers to questions. Reduced time and costs of professional development Improved quality of decisions. More perspectives on problems. Standardisation and synergy across mathematical units. Ability to take risks with the backing of the community.
Benefits to Community Members	Help with challenges. Access to expertise. Better able to contribute to a team. Confidence in one's approach to problems. More meaningful participation. Sense of belonging.

Figure 6.1: Based on Wenger et al.'s 'Short and Long Term Value to Organisations and Community Members' (2002, p.16).

6.2 What I have learned from studying socio-cultural theory, activity theory and group theory

In the Critical Analytical Study I suggested that socio-cultural theory and constructivism both highlight the role of activity in mathematical learning. The emphasis though, is different: socio-cultural theorists, for example Lave and Wenger (1991), link activity to participation in culturally organised settings whereas constructivists such as Piaget, (1929), (cited in Smith *et al.*, 2003) seem to give priority to conceptual activity such as the development of sensory-motor skills.

Through my reading and involvement in action learning I have come to see that, although I set up the community of inquiry in the socio-cultural tradition with the emphasis on social interaction as a context for learning, in the analysis of the transcripts I have adopted a constructivist position where “value is given to the reorganisation of individual cognition”

(Simon, 1995, p.116) as a result of intense questioning. Cobb (1994) argues that both perspectives are necessary to understand learning in the classroom. He suggests that:

“Mathematical learning should be viewed as both a process of active individual construction and a process of enculturation into the mathematical practices of wider society”.

(Cobb, 1994, p.14)

My understanding of this is that knowledge and appreciation of both points of view are useful to the researcher and that these two perspectives of mathematical learning are not polarised.

Set One fulfilled some of the criteria of a learning community (*Figure 6.1*). It had some of the elements of short-term value, showed genuine collaboration, and the ability to reflect on learning. It also sought to develop innovative practice (Fielding *et al.*, 2005).

Engeström’s (2001) activity theory explains how a wide range of factors across macro and micro conditions can combine to develop educational practice. This helped me to make sense of the conceptual space (which I find very difficult to describe) between the different forms of being and learning: first, that of experience and identity; second, that which each set member experiences in sessions;

According to activity theory, the emergence and the development of the mind is determined by the activity in which it is engaged. It is a useful way of making sense of the complexities of how teacher knowledge is derived, developed and used in Set One. I have come to see, though, that the factors I originally assigned to Engeström’s model (*Figure 2.2*) are not fixed. The strong structure of the triangle disguises the elasticity and constant movement within its boundaries; an activity system does not attempt to seek equilibrium, turbulence and uncertainties are almost a pre-requisite of change. Engeström’s five principles (2001), located against the four central questions in his matrix for the analysis of expansive learning (*Figure 6.2*), remind me that learning is not just about acquiring knowledge and skills, it is also about changing conditions and responding to new needs.

	<i>Activity system as unit of analysis</i>	Multi-voicedness	Historicity	Contradictions	Expansive cycles
Who are the subjects of learning?	Set One	Varying points of view and emotions from set members' experiences.	The teachers and managers in Set One and their previous experience.	Individual change for some set members.	Learning is a continuous process throughout a teacher's life.
Why do they learn?	Pressure to perform in national tests.	The set needs new knowledge and a new way of teaching.	Poor Year 6 test results. Weak teacher knowledge.	Beliefs about mathematics challenged in sessions.	Continually changing circumstances
What do they learn?	How to use open-ended questions as a source of learning.	There are alternative models for learning.	Educational aims of LA/government in conflict with perception of 'effective practice'.	Change can be frustrating, challenging and energising	New ideas emerge about learning.
How do they learn?	Through reflection on knowledge and collaboration combined with experience.	Interacting with each other through dialogue	Traditionally, through transmission teaching.	Beliefs challenged. Learning through questioning and challenge.	Continuous interaction with each other.

Figure 6.2: Engeström's matrix for the analysis of expansive learning applied to action learning.

Using activity theory has helped me to evaluate the shared space in which set members have operated, and to consider individual and collective gains but this approach by itself, does not help me understand how new knowledge might be generated by using existing knowledge in Set One. Combining the constructivist and socio-cultural point of view enabled me to think of the process as systematic change which involved the synthesis of subject knowledge, national curricular and strategy knowledge and pedagogic knowledge. This new knowledge was related not only to the individual but also to the Set One identity. Having the Hawksridge senior management team as a considerable proportion of Set One was an important factor in the transference of Set One principles into Hawksridge school. The reflective techniques practised in Set One have become embedded in Hawksridge's way of working.

Set members' principles and beliefs about the teaching of mathematics were challenged during Set One meetings. J1's comment that she had 'allowed herself to be challenged' and it

was ‘not so frightening’ as she had thought it was going to be, followed by her subsequent actions in rewriting her lesson plans on ‘time’, are a good example of this. Likewise R (session four) found herself challenged when asked to share her understanding of the mathematical term ‘difference’.

R: Oh hmmm ... I don't know ... (sighs) ... I don't know ... Let me think ... OK in literacy we were talking about similarities and differences. Do you think that might have confused them? When I ask for what is similar for example between two characters they can say and then after a bit they could say what's different. Oh ... OK

A: How are you going to deal with their understanding between say the difference between two characters and the difference between two numbers because you're using the same word but the meanings different?

R: Yeah, ... (sighs) yeah ... could be. Yeah it could be that. They're good at literacy, but struggling with numeracy.

Critics of expansive learning (i.e. Young, 2001) point out that it does not necessarily enable a learner to access knowledge, which does not come out of practice, and this is the case for R. She still does not know how to help her children understand the ‘difference’ mathematically, but in her debrief she understood that she had been imprecise in her use of mathematical language.

R: I hadn't really thought about that before ... I need to be more aware of what I say ... Maybe plan for it a bit better.

Von Glasersfeld (1989) suggests that one of the limitations of the socio-cultural approach is that participants can only interpret their actions within the context of their activity. R's involvement in Set One enabled her to broaden her perspective through the collective knowledge of set members but she was still unable to find a way to relate it to her teaching.

My readings on group theory (Luft, 1984) helped me to analyse collaborative work, what was going well in sessions, and determine how I could assess this information to support the development of new knowledge for Hawksridge.

Underpinning group theory is the notion that a group can be more effective at solving problems than people working alone. I was mindful of the four categories Luft devised to measure effective team performance. To be effective a group must meet certain criteria:

- Some *interaction* must take place;
- Some *purpose or goal* must be shared;
- Some different behaviour or function must begin to emerge (*integration*);
- There has to be more worth to being in the group than being outside it (*pattern maintenance*).

(Luft, 1984, p.7)

Luft's contention, that when a group assembles for a particular purpose they primarily concern themselves with content, was particularly true of Set One. In all of its meetings the focus was mathematics teaching.

Luft's first category of *interaction* was fulfilled in Set One. In the second category the goal or purpose had two levels. First, there was the purpose of challenging the presenter of an issue through open-ended questions and helping them to develop their knowledge, tacit or otherwise, and pedagogical skills. Second, I recognise that the intrinsic goal and purpose for each individual set member was probably different. It was highly probable that each had a different agenda, which they may or not have suspended during the sessions. Indeed headteacher debriefs at the end of the set confirmed this.

It is not easy to tell whether or not Luft's third criterion of *integration* was met. Certainly the set became better at asking open-ended questions and demonstrated improved listening skills, but whether or not this informed practice back in the four schools is another matter. At Hawksridge, the senior managers made good use of their improved questioning skills in the classroom and during senior management meetings.

For some members of Set One the group could not fulfil Luft's last criterion (*pattern maintenance*): that there is more worth being in a group than being outside it. One coordinator only attended two meetings and another attended three. Set One could not fulfil their personal or professional needs and the opportunity to find out why did not arise, although their headteachers hinted at the 'why' in their debriefs.

Hawksridge and Hampton made very good use of the group. They learned to use the group structure in their own way as originally intended. Hawksridge eventually summarised the effectiveness of their own brand of action learning, Set Two, and were shortlisted for the

Times Educational Supplement (TES) mathematical innovation of the year in 2010. They went on to win a ‘Highly Commended’ citation in that category (Appendix 3).

6.3 Theory and dialogue in action learning

In my Critical Analytical Study I explored the contribution of Vygotsky (1986) to theories of learning, and I have looked again at his work on the role of language in higher mental functions. Vygotsky established the principle that the intellectual development of the individual cannot be understood without taking into account interactions in their own social environment. He also noted that this social environment is influenced by a wider culture incorporating organisations, artefacts and semiotic tools such as that of speech. Vygotsky thus linked the macro and the micro and firmly established language (or discourse) as an important tool. He established its prime role in learning.

The principle of constructing and reconstructing thought is, I believe, embedded in the more successful action learning sessions. For example, in session four the presenter began to consider her use of mathematical language. R was presenting her issue – her children were able to subtract but they did not seem to understand the word ‘difference’ when presented in a mathematical context:

A: The question that you gave them. What did you think about the language in it and how could you have offered them more support?

R: Well no, they had pictures as well as the words so they could see the problem.

A: How do you think your children have made the link before ... between ... ummm ... different kinds of vocabulary before you came to ‘find the difference?’

R: Ah ... ummmm I don’t know ... I was kind of thinking about that, and I think they haven’t made the link yet, I’m sure that they know that take away and subtraction means the same, but ... I think they ... they think that ‘find the difference?’ is something completely different I hadn’t thought about that. ... I don’t think I’ve made the link properly. I’ve been thinking about this for a long time and I’m still not sure.

It now seems to me that reflective activities have the capacity to deliver professional development in a number of key ways. First, they can enable teachers to develop the technical

aspects of effective practice. (In session four, for example, the understanding that some mathematical words may have an everyday meaning.) Second, they provide an opportunity for a presenter to review thoughts and ideas about mathematics teaching (the teaching of difference to young children). Third, there is the opportunity to combine the different types of knowledge held with the experiences of a broader field of professionals.

It seems neglectful to embark upon a piece of action research, in which dialogue is the prime means of study, without exploring the influence of Habermas and his critical theoretic orientation. A critical theory claims to be a special form of knowledge. It claims to provide a guide to human action by helping people to understand their true interests and by helping them escape from ideological coercion. Participants in the formation of a critical theory take a questioning stance towards their own practice. Habermas maintains that understanding comes about through the use of reflection, and that knowledge is the result of the process of critical thinking, which combines reflection and action. Habermas does not claim that people can resolve all problems simply by sitting around and talking about them; instead he recognises that participants bring their own personal agendas to discourses and seek to exercise their power and influence towards results that would be advantageous for them. At this point I feel very in tune with what Habermas has to say, but in fact his work is slightly ambiguous about how good a discourse has to be in order to meet his ideal.

Habermas's basic rules of discourse are:

- Everyone who can speak may take part in the discourse;
- Everyone may problematise any assertion;
- Everyone may introduce any assertion into the discussion;
- Everyone may express his or her attitudes, wishes and needs;
- No speaker may be prevented from exercising the rights laid down in (1) and (2) by any kind of coercion internal or external to the discourse.

(Froomkin, 2003)

To achieve the Habermas ideal in action learning seems impossible, since the Set One members have only their own experiences and knowledge to draw upon, and this participant knowledge cannot be perfect and provide all of the answers. It is possible, however, to link

some of the ideal principles of Habermas in the operational structure of action learning (*Figure 6.3*).

Habermas's standards for best practical discourse	Action learning processes
A proper moral discourse requires that all voices (in any way that is relevant) get a hearing.	In Set One all of the participants have equal access to the floor. Having the floor places a claim on the attention of the other participants.
Discourse ethics require that people listen to all participants.	Listening is a key skill in action learning. Analysis indicates that improved listening skills leads to better levels of participation and deeper reflection.
Best practical discourse requires that the best arguments available given the present state of knowledge are brought to bear upon the meeting.	In action learning Set One brought its collective educational experience and knowledge to bear upon the mathematical dilemma.
"Only the unforced force of the better argument determines the 'yes' and 'no' responses of the participants." (Froomkin, 2003).	In action learning no one person should have more credibility than any other. Other than the facilitator, whose role is to 'facilitate', there is no formal rank and experience only has as much weight as the listeners wish to afford it. As a result participants have few options other than to persuade through force of questioning.
Best practice discourse should incorporate a reflective aspect.	Action learning has at its heart reflection on practice whilst practising the skills of reflection.

Figure 6.3: linking Habermas's Critical Theory to action learning Set One discourse.

One of the core purposes of this research is to help practitioners comprehend that teaching and learning depend heavily on the capacity of individual teachers to view learning as understanding and understanding as self-reflection. In Habermas's terms this would lead to critical knowing and hence to action. One of the by-products of action learning is that it has raised a kind of critical consciousness about what good mathematical practice should look like, and this is inextricably linked to the social and cultural world in which teachers operate. It is not just about learning mathematical skills and processes; action learning is about making the effort to question what has been taken for granted (the national strategy and the national curriculum) and to question what lies beneath the experiences of daily classroom teaching.

Habermas's conditions for ideal discourse in this context are aspirational because action learning does not permit free debate: it is constrained by procedures and the knowledge and experience brought by the participants. It is a useful benchmark but the conditions are too

demanding. Designing a structure that takes account of all of the conditions is no easy task. Action learning Set One did not have a free agenda because it was constrained in the amount of time it had available for discussion; participants did attempt to manipulate the conversation on more than one occasion. Three facts, however, are clear. First, there is room for improvement in the process (action learning Sets Two and Three, Appendix F). Second, good quality discourse offers hope for improvement and it can enhance a teacher's knowledge about their work. Third, action learning Set One demonstrated that high level discourse is attainable given the right conditions and is certainly worth striving for.

6.4 Conclusion to theory, action research and action learning

Theory is an essential part of research and action learning is not exempt. To deny the place of theory in research is to deny the practice of teaching a framework for analysis and reflection. In Chapter 3 I noted differences between theory and action research. Theory, I believe, gives sustenance to action learning Set One and it helps me to make sense of the dialogical space created in action learning sessions. In the process I see that teachers begin to develop and extend the wide range of knowledge that they require in order to function effectively in the classroom.

Without an understanding of theory it is difficult to explore phenomena in depth. In mathematics it enables the researcher to make links between different types of knowledge that a teacher might hold and how this affects their work. It provides a language of its own to describe and account for the idiosyncrasies that arise when engaging in a new way of working. The generality of a theory allows the researcher to engage with the data at a more abstract level of understanding, and to connect the psychological, social and cultural dimensions that impact on the daily work of mathematics teachers. My understanding of the theories I have used enriches my work as a researcher, leader and manager.

In my final chapter I assess what I have learned, what the set members have learned and what the implications are for future practice at Hawksridge. I look at the contribution this piece of research has made to the field of mathematics teaching, what it affirms, what it queries and what questions it leaves unanswered. Finally, I look at what I have learned and evaluate the

positive impact that action learning has had on Hawksridge since that has always been one of the intended benefits of this research.

Chapter 7

Concluding discussion

In this section I return to my research questions assessing what I have learned personally and as an observer of a mathematical community of inquiry. I look at the area of professional development that action learning has opened up and consider what contribution this piece of research has made to what we already know about the field. I am aware of the impact of Set Two and will endeavor not to ascribe any characteristics to Set One that are peculiar to Set Two. However since the intention of this piece of research was to create a model for Hawksridge, I will look at what I have carried forward from Set One to Set Two and Set Three.

7.1 The main messages

I have learned that action learning is a powerful tool that can help teachers develop their professional dialogical skills in a number of ways, and Hawksridge as planned, has taken this knowledge and benefitted from it. First, in Set One, teachers were able to practice the skills of open-ended questioning in a dedicated, supportive environment. This is not as simple or as easy as it appears and questionnaire returns at the end of sessions acknowledge the difficulty of asking continuous open-ended questions. Participants found it difficult to move away from giving advice to the presenter of the mathematical dilemma and equally difficult to refrain from leading the conversation in a direction they wished to go. Armed with a sheet of ‘stem question starters’ (Appendix A) drawn from the initial sessions, Set One eventually became very adept at asking open-ended questions and building stacks of questions that challenged the thinking of the presenters. In the analysis it became clear that it was either the ‘stacks’ of questions or some inspired questioning in a small ‘run’ by an individual, which led to the ‘lightbulb’ moments. By ‘lightbulb’ moments I use a phrase from the transcripts, which I have interpreted as the moment when teachers make a connection between new experience and previously held knowledge. It was very rare to find one question that could provoke deep reflection on action. Hawksridge staff have benefitted from the knowledge that action learning should be practised in a supportive environment. They experiment in action learning

sessions and support each other when struggling with open-ended questions. *Figure 7.1* demonstrates how the original four points for improvement from the 2007 Evaluation Research have been implemented at Hawksridge as a result of action learning.

Evaluation point	How Hawksridge has developed its teaching
Develop a collaborative culture.	Action learning Set Two in place in a supportive setting. Partnership work between year groups has grown. Regular discussions about 'what works' across year groups.
Instigate a rich mathematical dialogue.	Evident in action learning sessions and in lessons where staff are more confident, particularly when asking open-ended questions. Lessons are dialogue rich with pupils and teachers sharing ideas and giving explanations.
Provide the time and space to achieve the above.	Dedicated staff meeting times for action learning. Informal time at the end of the day to discuss learning and what needs to happen next. Dedicated training days and training with high profile speakers. Ensured mathematics coordinator is well trained and a specialist teacher.
Ensure training is carried out in-situ so that it is closely linked to the needs of the school.	Professional development is related to: a) individual need and level of experience, and b) whole school requirements, for example the use of the empty number line. c) research that relates to classroom practice. d) how children learn.

Figure 7.1: How Hawksridge used the information from Set One to inform its practice.

Second, Set One was able to recognise the power of open-ended questioning in allowing the presenter to take ownership of an issue. The analysis indicated that not all open-ended questions were powerful; the power lay in the careful listening of the set members to the mathematical dilemma and their ability to draw out the tacit and learned knowledge of the presenter so that they were able to think about the children they taught in a holistic way. As a result of the analysis, Hawksridge staff know that there are different types of questions; for example, orientating, guiding, leading and enabling and that these can extract different types of information.

Third, the set appreciated the dedicated time and space to try out their ideas, reflect on the different viewpoints that emerged, and reach their own conclusions based on their own

beliefs, experience in the field and exposure to a new way of thinking and working. Teachers in the set demonstrated that they could be flexible in their thinking and that they had the capacity to select or suspend their ideas. Five set members used the process to try out their ideas for whole staff development; they used the open-ended questioning style back in schools to enable their own staff to take ownership of mathematical learning. As a manager, I learned that I must dedicate time and space to develop mathematical dialogue, that it wouldn't just happen and that it needed direction and focus. Hawksridge staff are continually exposed to this way of thinking and working and I think, as a consequence, are more open to new ideas.

Collaboration is a key feature of action learning sessions. In the debriefs, teachers indicated that through this kind of collaboration they were gaining knowledge about what was being taught in other year groups; they were developing their 'horizon knowledge' (Ball et al., 2008). The mathematical lines of development became clearer to them and they were able to make connections to what had gone before and how that might affect their current teaching. Collaboration also meant that teachers from Key Stage 1, for example, could see where their work on patterning led to in Key Stage 2. Conversely, Key Stage 2 teachers began to understand that without careful teaching of early concepts such as 'equal' children were unprepared for what came next. Hawksridge staff have made good use of this information. They know that if they are struggling with a child's mathematical understanding, someone else on the staff may have the knowledge, which will help them move forward. This type of collaboration is, I think, powerful professional development.

That action learning is a powerful tool, only occurred to me late in the process. The manner in which dialogue is constructed reveals not only the subject and pedagogical knowledge base of a teacher it also exposes what binds them to a particular stance. It can reveal their beliefs, previous experiences and ideals about what effective teaching should look like and how each individual has been shaped by their socio-political and socio-cultural landscape. I have come to the conclusion that it can be used creatively to foster professional development but in the wrong hands it can also undermine teacher confidence and competence. It has a powerful managerial dimension, which is open to misuse and/or abuse.

Action learning does not suit everyone. Not all teachers are able to suspend judgment, reflect on their actions constructively and be flexible enough to accept new ideas. Effective reflective practice requires that teachers can see the possibilities of learning through experience. In the classroom on a day-to-day basis, teachers have to respond to a myriad of decisions, some unconscious and some not. They have to respond ‘on the hoof’ and the time for reflection is rarely available during a busy lesson. Good questioning in action learning sessions can begin to unpick these conscious and subconscious actions and it is particularly successful if the presenter has high self-efficacy.

There were process issues in early action learning sessions. Members wanted more opportunities to act as facilitator and felt that more people might provide a wider range of questions although analysis shows that this was not always the case. Not being able to ask leading questions often frustrated members particularly as once an idea had been mentioned it was almost impossible to ignore it. Timing was also an issue. Some set members wanted time at the end to gather the thoughts that had arisen so they could share them with their senior leadership teams. Transcripts were made available to attendees but inevitably they did not capture the thought and ideas of the individual set members during the sessions.

7.2 What has been learned?

For myself, I recognise that whilst action learning might not be the keystone of professional development for all that I first thought it could be, it has sufficient merit for it to be considered at least an influential element in professional development.

My first research question focused on whether action learning could extend and develop teacher knowledge: action learning at its best can empower teachers with a way of thinking and working which is not to be found in text books, schemes of work, national strategies or reports. It can extend and develop teacher knowledge but it is not always reliable in its outcomes. It is dependent upon the composition of the group, the level of subject knowledge and professional expertise.

My second question demanded that I consider the ways in which action learning might enable teachers to draw on their levels of expertise and skills. I have found it helpful to consider three of the main characteristics of action learning against three key features: reflection, dialogue and collaboration. (*Figure 7.2*)

	Action learning at its best	Action learning at its worst
Reflection	Meditative, with individuals considering their own perspectives in the light of experience.	Does not move beyond description of what happened in a lesson.
Dialogue	Mathematical dialogue drawing on the different types of knowledge defined in Chapter 4.	Burbling. Recounting an activity. Highly descriptive of what happened practically.
Collaboration	Listening as competent participation. Active listening not only to the presenter but also to each others' questions.	A scattergun approach, unconnected one-off questions. Disjointed questioning. Too many silences and 'jumping in' to ask questions without giving the presenter 'wait time'.

Figure 7.2: Action learning Set One spectrums.

There have been other lessons that I have learned from Set One that I have carried into Set Two and Set Three. The power of open-ended questioning to develop a teacher's mathematical thinking continues to astonish me whenever I am in a session. It is not only the development of pedagogic content skills, which I can now see more easily, but the development of other types of knowledge. This may be so because I am more practised at recognising them. In Set Three (Appendix H) a debrief with a presenter confirmed members thoughts from Sets One and Two. He noted how empowering the process was / is:

and
 'You're on this journey.... and yes, you're being prompted to think.'
 'I felt quite empowered and listened to. It really felt that I was being listened to.'

There is sufficient evidence in the action learning dialogues to indicate that teachers can and do make use of a range of knowledge when given the time and space to consider real life problems in a realistic context. However, the teachers in the research tended to stay with practical issues, did not make connections in learning or readily see relationships without the structure of action learning techniques, namely, skilful and probing questions; they were often reluctant to move beyond their practical experience. Transcripts and analysis indicates that the more experienced the teacher, the more confidently they were able to move between the different types of knowledge outlined in (Chapter 4. *Table 4.2*). I would suggest however, that this knowledge, remains tacit and in isolation unless there is an opportunity to articulate or reflect.

The inquiries that Set One engaged in were typical of everyday problems facing teachers. I do not think it was the actual inquiry that prompted the teachers to rethink their mathematical position; I believe it was the process that they were engaged in. The role of a particular type of dialogue in shaping the way set members conversed about mathematical actions illuminates the important connection between dialogue and reasoning, however I still cannot see clearly how this affects practice. I only know that in Set Two, repeated exposure to this type of inquiry and dialogue had (and continues to have) a profound affect on Hawksridge staff.

Bourdieu draws attention to how our socio-cultural context can limit our reasoning and this implies that teachers are limited in how they can reflect upon their own practice without intervention. ‘Polite’ conflict is one such intervention typified in action learning. Questioners challenge the presenter to justify why they have carried out particular actions. For the presenter this is not always a comfortable situation but it ensures that dialogue is more than simple recounting of an activity whilst presenters are forced to reconsider their actions.

Hawksridge staff are enthusiastic about action learning. The majority (we have three new staff) are what Peter John calls ‘enabled professionals’. They have:

‘The capacity to respond to changing condition and redefine their practice so that they are enabled rather than constrained by external policy agenda.’ (John, 2006, cited in Sutherland, 2007, p.273)

In this, I include myself. This stance does not always make Hawksridge staff easy to manage; creating a culture where it is acceptable to ask challenging questions and question the status quo is not always a comfortable experience but I have learned to value this over the last five years.

7.3 Facilitating teacher development

My third research question considered whether action learning could facilitate teachers' development of pedagogy at different points in their professional lives. The amount of experience a teacher has seems to dictate their ability to draw on a range of knowledge and skills. In part this is to be expected because less experienced teachers do not have the range of experience to call upon. However more experienced teachers in Set One seemed to be more able to separate the 'seeing' of the dilemma from the action of the lesson. They were less caught up in what they did, less inclined to describe what happened and either consciously or subconsciously filtered their actions. They were more capable of analysing and making meaning from their experience. Less experienced teachers demonstrated different emotions when faced with the challenges of action learning. They wanted immediate answers to their problem, ideas for future action and they felt frustrated and emotional when asked to explore their own knowledge and skills. Debriefing interviews indicated that inexperienced teachers in Set One were less inclined to enjoy the search for clarity and understanding. My previous and current research leads me to believe that it is also related to their socio-cultural position and particularly the institution in which they work. This research demonstrates that young teachers such as J1 can be reflective in considerable depth provided they are given the right kind of opportunities.

All of the teachers in Set One were confident in their ability to teach and eventually all of the regular attendees were able to cope with the demands of open-ended questioning, listening carefully to dilemmas and working in partnership to make connections between teaching and learning. Analysis shows that they began to operate on three planes: first they began to make connections across mathematical ideas, second, they began to make closer links between teaching and learning and third, more experienced teachers were able to integrate the two

planes and operate on a third level. This third level, I think is of a higher order than the first two and requires a greater degree of synthesis.

Action learning is not always a comfortable experience because dissonance is a part of the way it functions. For it to work well there must be trust, truthfulness and integrity. The difficulty for Set One was that its members had to learn this skill in a new group as well as a new process.

7.4 The contribution of this research to the field

This action research project affirms the importance of teacher reflection and a rich mathematical dialogue. Done well, it also demonstrates that action learning can test the worth of ideas and actions in relation to classroom mathematical problems. It can provoke teachers to deeper mathematical thinking and potentially result in enhanced pedagogical content knowledge. It also shows that dialogue can act as a catalyst for change in the way teachers approach their work with children.

This kind of work supports the view that learning through experience and reflecting upon that experience in a structured way can provide new insights or changed perceptions of actual classroom practice. This is different from seeing teacher professional development as a way of acquiring new ways of functioning. It is also different to seeing understanding as a form of acquisition. Meaning making comes from the sharing of professional experiences and reflection. These in turn draw on a teacher's knowledge foundation, personal experiences and their understanding of mathematical concepts.

My analysis has helped me to understand in greater depth the different forms of knowledge that teachers bring to the act of teaching. I was surprised at how often the national strategy techniques were mentioned as a source of knowledge for teaching and how teachers use

national curriculum knowledge (for example, working at a Level 2B) to define a child's understanding of a mathematical concept. This lack of connection between national curriculum knowledge, strategy knowledge, subject knowledge and how children learn seems to me to be a major impediment to supporting children's mathematical development. The confines of such a narrow band of knowledge limits teachers' understanding of the context in which they work. Conversing in this disconnected way seems to inhibit teachers speaking about children learning mathematics.

Penlington's work (2008) begins to show how it is that teacher - teacher dialogue is effective as a professional learning activity and this action research project suggests that some types of dialogue are more effective than others for teacher's professional development. Action learning demonstrates that some teacher knowledge is 'hard to get at' and that whilst it is not difficult to recognise teacher subject knowledge it is less easy to probe the pedagogical base. How teachers understand mathematical procedures and how they make connections between the different types of mathematical knowledge affects the way that they think and teach (Ball et al., 2008; Ma, 2010). In action learning sessions, having to explain and justify why and how a concept has been taught a particular way demands that they share their pedagogical base. Actions that a teacher takes for granted, reasonable in their eyes, may not be so in the eyes of others. The action learning transcripts for Set One demonstrate that teachers had to go beyond their own justifications to themselves and to a degree occupy the spaces inhabited by the other participants. In doing so they began to see a wider set of factors in their actions; for some this was exhilarating, for others it was emotionally difficult to manage. Action learning is however unpredictable; it can probe teacher assumptions about procedures but it does not necessarily change them.

This research also explores what type of dialogue is best for teachers at different stages of their careers. Too much challenge in the dialogue can have the effect of emotionally upsetting teachers who have only recently qualified. The analysis shows that this can affect their capacity to reflect in depth.

7.5 The impact on Hawksridge

In the Evaluation Research four years ago when I first identified the four key areas that I saw as crucial for mathematical improvement at Hawksridge I wondered how I would even begin to put my own recommendations into place. The four areas were:

- Develop a collaborative culture.
- Instigate a rich mathematical dialogue.
- Provide the time and space to achieve the above.
- Ensure training is carried out in-situ so that it is closely linked to the needs of the school.

Action learning has been operational at Hawksridge (Set Two) for eighteen months. It is a part of its way of thinking and being. Classroom teaching based on a probing, dialogic questioning style has improved dramatically and mathematical performance likewise. Teachers and children are much more confident in their ability to think and reflect. Action learning sessions take place once every half term and they are a source of learning for managers and teachers alike. Teachers are better at sharing information and knowledge, better at asking questions and more likely to question local and national training and assess its usefulness. They now search for answers about why children find it difficult to learn new concepts by unpicking the concept itself and they try to make conceptual links across the mathematical curriculum. More experienced teachers demand information about how children learn and this has altered the professional development that we engage in.

For myself, I know that my professional outlook has changed. I have moved from my original positivist stance to that of the social constructivist and I believe that my interpretative stance has affected the way I think and behave on a daily basis. I have learned to listen more carefully to the difficulties my staff face, consider their problems from multiple perspectives and I arrange training that will help them to improve their knowledge of mathematical procedures and how children learn rather than accept national training that is meant to fit all schools. I do not expect instant results from my actions as a leader instead I try to think about Peters and Ragland's (2005) concept of levelizing and how I might use their frames of reference to understand not only teachers, but my pupils, their families and the community. My improved knowledge has given me confidence and I am less likely to be buffeted by external change. All of the four recommendations are in place.

In July 2010, Hawksridge was assessed as making outstanding progress in mathematics by a visiting HMI. The school has risen from the 99th national percentile to the first. It is currently the second highest primary school in London for ‘value added’ at key stage 1 to key stage 2 and is ranked fifth, nationally. In June 2010, the action learning research was highly commended in the Times Educational Supplement’s Annual Awards. In December 2010, Hawksridge was described as an ‘influential institution’ by the NCETM and commissioned to lead its work into ‘Action Learning Set Three’.

I do not claim any special qualities for action learning Set One; neither do I claim to have solved my mathematical problem. It is what I have learned on my journey in action learning Set One, (and now Set Two and Set Three) that has guided school improvement at Hawksridge. We have learned a new collaborative way of working which relies strongly on discourse. This has impacted on our classroom practice because we now understand the power of language in learning. We have learned to think for ourselves and explore mathematical issues together. In doing so we have repositioned our school, created a new ‘can do’ ethos and we have confidence in what we know. Hawksridge at last has a sense of purpose.

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Appendix A

Some open-ended stem question starters from the action learning sessions

Can you give us
an example of....?

It might be
useful for us to
know.....?

Can you add a
bit more
about.....?

What do you
think the reasons
might be for...?

Tell me what
you do first.....?

So what did you
do when...?

How can you
use what you
know about
HOW children
learn?

How would you help
the children
who.....?

How do
they.....?

So where do you
think you can take
it from there....?

How might that
help their
understanding
of.....?

How are you
going to.....?

How did you
begin to.....?

What do you think
would happen
if.....?

Appendix B

Set One end of session questionnaire

Action Learning

What have I gained from the learning 'set' today?

- a) for myself

- b) in my work

- c) how I might support other colleagues

Are there any changes I might make in my work?

What has gone well?

What could be better?

Thank you for your time

Lin

Appendix C

Action learning Set Three 'end of session' questionnaire showing the development of questions

Did you make use of any of the techniques from the first session? (Please describe)

a) open ended questioning? (in class or with colleagues)

b) building on answers to promote deeper thinking? (in class or with colleagues)

c) enhanced listening skills

d) collaborative techniques with dialogue

What have I gained from the learning 'set' today?

e) for myself

f) in my work

g) how I might support other colleagues

Are there any changes I might make in my work?

What has gone well?

What could be better?

Thank you for your time

Appendix D

Informed Consent Form

My name is Lin Phillips. I am engaged in a piece of research for my professional doctorate at Sussex University entitled 'Does engaging in Mathematical Active Learning have the capacity to bring about changes in teachers mathematical practice?'

I am the sole director of the project and can be contacted at 'Hawksbridge Primary School Tel: XXXXXXXXXX should you have any questions or need to contact me at any time.

Thank you for agreeing to take part in my research and Community of Inquiry. Before we start I would like to emphasise that:

- your participation is entirely voluntary
- you are free to refuse to answer any question
- you are free to withdraw at any time

I plan to record Action Learning sessions and transcribe them. Transcriptions will be available for all to see who have attended the meeting. Identities will be removed. Individual interview transcriptions will also be available for participants if they wish to see them.

The interviews will be kept strictly confidential and will only be perused by myself. Excerpts from the interview may be made part of the final research report, but under no circumstances will your name or any identifying characteristics be included in the report.

Please sign this form to show that I have communicated the contents to you.

_____ (signed)

_____ (printed)

_____ (Date)

Please send a report on the findings of the project

YES

NO (circle one)

Address for those requesting a report

Appendix E

Entry for the Times Educational Supplement Awards 2010

In 2004 we were the bottom school in the Local Authority for maths. (25% at level 4)

In 2009 we achieved 97% at level 4+ with 55% of pupils achieving a level 5

We have moved from the 99th percentile to the first in maths.

The Innovation

In 2009 we embarked on a programme called Action Learning. This was a part of our headteacher's research for her doctoral thesis. Her work in the first three years had guided our progress and we could see steady improvement year on year but it was the development of the Action Learning programme which put the icing on the cake.

What is Action Learning?

Action Learning is based on original work by Carl Rogers. The underpinning rationale is that learners are supported in looking at problems identified by themselves. Over the course of this year we have held deep discussions about mathematical issues such as

- how we teach mathematical problem solving
- how can we help children to understand equivalence in weight.

Honing the Skills Carefully

Our Senior Management Team developed their questioning skills in the original testing model known as Set One. When we felt we had acquired enough expertise in open-ended questioning (Socratic Questioning), we brought it into the school. First of all we worked in triads with a presenter of an issue, a questioner and a facilitator who made sure the questions were open ended. We then tried it as a whole staff.

How Did This Help Us?

We are better at:

- working and thinking collaboratively - it helps us all to sing from the same sheet and we can use each other's knowledge to help build and develop our own. When you're in the 'hot seat' as presenter you can explore, begin to understand and explore the act of teaching and learning and begin to connect the two;
- Having a common purpose. After a long period of staff mobility we began to develop our school identity. It helped us to become a 'community of practice';
- finding time and space to reflect on what we teach mathematically and how we teach it;
- we have a better understanding of what happens in maths in other year groups;
- asking open-ended questions in our lessons;
- making mathematical connections in our teaching;
- it facilitates the importance of sharing ideas;
- because as adults we were practising using dialogue as a means of learning we began to appreciate how important dialogue was in the classroom.

Our outcomes have not just been improvements in our mathematical achievements. We have noticed a real buzz after an action learning meeting. Our staff say that it makes them feel valued, that someone is listening to them properly. Experienced and new teachers enjoy it for

different reasons. Older members feel that their vast experience of teaching maths and the knowledge they have acquired is properly recognised. Younger members of staff are keen to learn and consolidate and improve their skills.

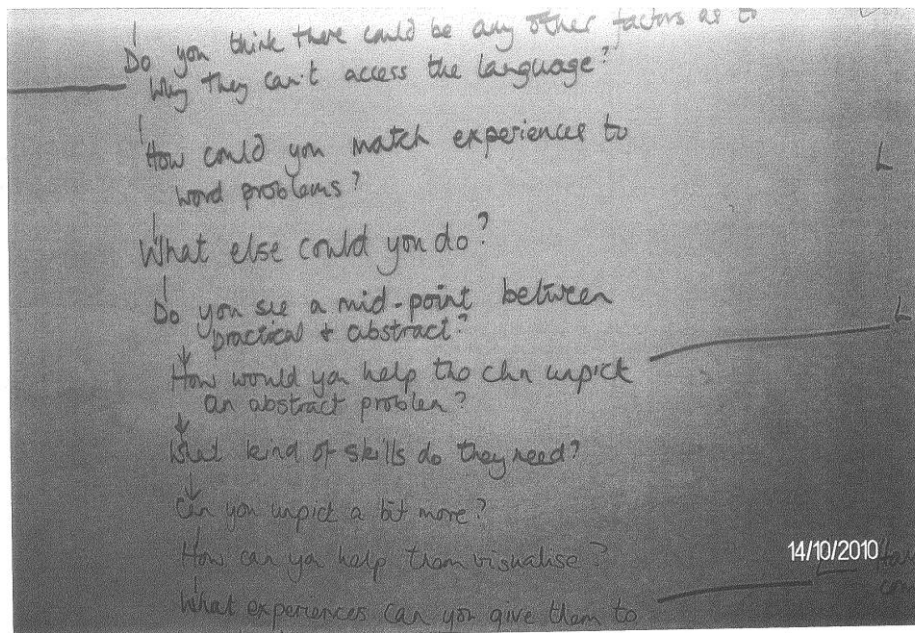
Appendix F

Tracking changes in action learning from Set One to Set Three

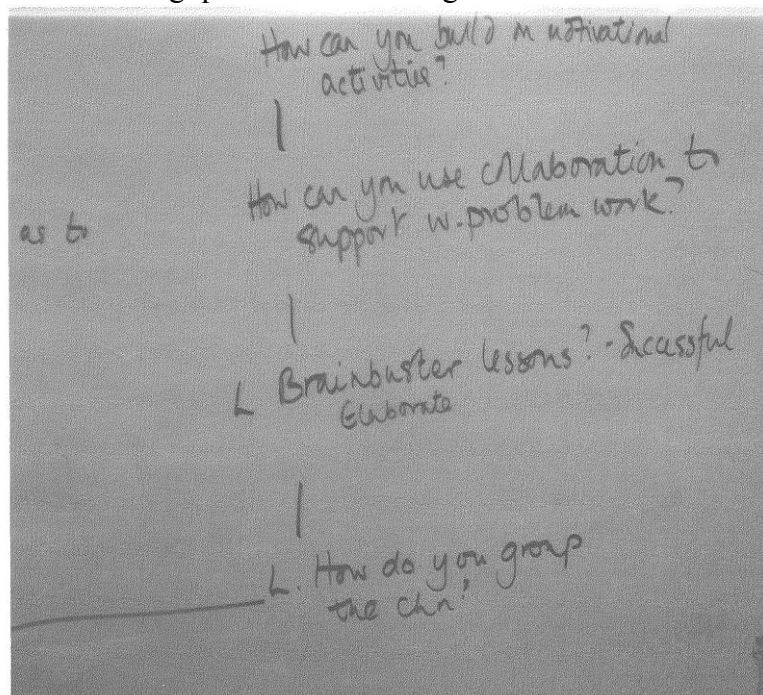
Group Function and Structure	Set One	Set Two	Set Three
Role of Facilitator	Introduces warm up event Monitors types of questions. Can allow some leading questions	Introduces warm up session Monitors types of questions Can allow some leading and guiding questions	Introduces warm up session Monitors types of questioning Writes questions down as they arise on visible board 'Parks' the leading questions Summarises the links at the end
Organisation	Whole group together	First session working in triads 1) a presenter of an issue 2) a facilitator 3) a questioner Second session a) 1 facilitator, 1 presenter of issue remainder of staff questioning	<u>First session</u> working in triads 1) a presenter of an issue 2) a facilitator 3) a questioner <u>Second session</u> 2 groups, 30 minutes each session Each group has a presenter and a facilitator Groups arranged in inner and outer circle <u>Session 1</u> : first group presents and second group listens. An empty chair in the first inner group allows any of the second group to enter the first discussion <u>Session 2</u> : groups change over Session 3: whole staff as an action learning set

Appendix G

A Set Three presenter's tracking of questions



She 'parks' the leading questions on the large whiteboard



Appendix H

A Set Three presenter's debrief

L: People have written in their returns from the learning set that they were happy to have the opportunity to reflect on their teaching, how does this resonate with the experience of presenting that you had the other night?

S: One of the most encouraging aspects of the process was me having the opportunity to think through the question and come to the solution myself without people intervening and er ... As I was working through my thought processes, you know of what we were talking about, I think I came up with some pretty good answers. Things that I could go away and think about and I can use those ideas, those thoughts in my future teaching. I can use that information in my future teaching.

L: It's good that you found the time and space to go back and reflect but not everyone has the same capacity, do you think that this process might help teachers who have not been exposed to this type of thinking or never experienced reflective learning before?

S: I think that all people in the classroom have to use reflection, on their pupils and on themselves. That's really fundamental to good practice, because if you don't reflect it's kind of ... well it doesn't give the respect to how complex the job really is... Hmm I think there are people who find it difficult to reflect and this is one way of encouraging that reflection and I think this could work ... definitely.

L: OK hmm the original title of the thesis was can this process of action learning improve teacher's subject knowledge and their pedagogical skills, their ...hmm... craft knowledge. Let's take subject knowledge first, what do you think?

S: I think it's the sharing process, it's not just me finding it quite cathartic or going on a cathartic monologue, people were listening and you have to listen well to ask an appropriate question. so it's relevant. And I got the impression that all of the people in the room were listening, you could almost see where they agreed with some of the things I said.... and it got so you could see people thinking where they were going with their own teaching. And I think also.... just talking about maths subject knowledge and the (*unclear dialogue*) is all healthy. The open questioning..... the technique this idea that we're using, you have to be quite adept at using it so that also feeds into good practice.

L: People were listening ... because I can tell from what they've written in the questionnaire returns that the answers that you were giving were making them think about their own practice. What about developing their craft skills, right across the school because we had teachers there from Early Years right up to Year 6 and the head.

S: Anything that gets people together talking and listening. My experiences of the Early Years aren't that great.... so it's good to get together and talk about problems, about good practice and it's about the language that you're using to teach or the

strategies that you use, just so that you can find out what they're doing and using that information to improve your own teaching. It's like primary and secondary, the amount of time I meet secondary teachers and we're just not on the same page. And that's because we never get together to talk. We're just not in the same room as each other.

L: I suppose we might not know what they want.

S: Yeah we don't know, and they don't know what we want and so just to get people together, talking, reflecting, listening; it's such a valuable thing to do.

L: You mentioned time and space to do it. One of the original set members described it as an oasis saying we're only going to talk about maths, and you know that you've got the space to do it.

S: Mm

L: What about the stem questions, could you make use of those in any sort of way?

S: They're good to start you off, a bit like with a class of children when you need a prompt, a start point, and then once you start using it..... the open questioning..... it's easier to use it and then you start thinking well what type of question am I going to ask now? Hmm I really like the questioning, you know, the whole idea.... it takes away the pressure of being told what to do..... the judgement calls..... and the whole idea that you're being listened to, you're on this journey.... and yes you're being prompted to think, being pushed into a direction on occasions. I like the idea that the person who's speaking has the control of what they want to speak about the issues you want to raise..... Its quite empowering I thought, yeah..... I did. I felt good after it.

L: That's interesting?

S: Yeah, I did. I felt quite empowered and listened to. It really felt that I was being listened to.

L: Listening,.....ummm yeah..... possibly a really under-related skill.. I've noticed how hard it is to really listen to what children are saying in the busy classroom.

S: Yeah. Definitely. I know my strengths and weaknesses, well I know some of my strengths and weaknesses as a teacher and a person in the classroom. I think I listen quite well in the classroom but I know out of the classroom I can fall into that trap of not listening. And I think something like that. I'd have liked the chance to listen and to practice my own questions and I think..... listening..... it does need developing its (*unclear dialogue*) just listening to people.

L: (*unclear dialogue*)

S: (*unclear dialogue*)

L: Another aspect of action learning is collaboration. What do you think about this idea of collaboration?

S: I think if it's done professionally and well err because whether you're in Early Years or in a secondary school, or in key stage 2, its the commonality of the job, the people that ... sometimes it's just not recognised, how much you have in common, you know the (*unclear*) of teaching or the logistical problems of teaching. And everybody finds it difficult they have to..... it's a difficult job so I think talking about it, well it helps you learn more about each other I think it can bring people closer, get people to collaborate more and it increases trust as well.

L: Mmm.

S: I think that's important so people feel that... I've had that many people... that many people after that session come to me.

L: Really!

S: I've had that many ... yeah..... It's been a difficult day..... because when I wasn't teaching I was talking to staff about well not just about the action learningbut they just seemed to feel they could talk to me, that they had something in common with me and they wanted to talk. It is really good..... all lunch time! But that's what you want isn't it..... You want people to push in the right direction....

L: Hmmm so an instant impact might be improved communication?

S: It certainly felt that way today. So yeah.

L: But all in one direction!

S: Well I do get lots of people coming to me anyway and there were quite a lot of people from the meeting asking me, just wanting to chat, just wanted to be listened to.

L: That's good.

S: Yeah I think it is yeah. I just ran out of time!

L: So it got communication going then?

S: Yeah.

L: Talking to each other on a really professional level?

S: Yeah.

L: Thinking about your work in depth?

S: Yeah.

L: And as you said, trusting each other because I guess you're asking someone to dig quite deep inside themselves. You're a manager, is there any way you think you can use this open style of questioning?

S: Yeah. Definitely. I've had quite a lot of experience in learning how to coach. It doesn't always come naturally to me, what does come naturally to me is telling people and I know that's not the best method ... for getting people to respond and I could be wrong and so I think that what I need to do is use this more. I need other people to take it more seriously when we do it. Because you could say well let's just chat and you could get off the subject quite easily so the ground rules need to be well established..... You know this is the formula this is where we want to go so I think I need to professionalise it here so that people can develop that skill of listening and talking because at the moment, I've got to be honest, I've tried coaching and I haven't tried the action learning really out yet and it's not that easy..... you have to treat it with respect it has to be done properly ... it's so easy to prompt and prod people otherwise and that's counter-productive, because that's not what you're there to do. The whole reflection idea ... definitely something I need to work on.

L: People have said in these [*holds up questionnaire returns*] that they value knowing that someone else has problems too.

S: Yeah.

L: And that they came to the realisation that they weren't on their own. And that they wanted to share that as well. I think though, the other night, there were a lot of people not contributing. We carried too many passengers.

S: Yeah not everyone likes to contribute and sometimes they're the people that you want to reach out to the most.

L: Do you think this might be a way of reaching out to them?

S: Yeah without a doubt I saw it yesterday and that wasn't what someone had said ... I could see by their body language that they were listening. So yeah, they did listen.

L: You're right. All the questionnaires were really well filled in and at length, except for two and they were very short.

S: I expect one was mine.

L: No. I spotted yours, it was different because you were presenting. But apart from the two.... everyone else had really thought about their responses, and gone into depth with their answers, which is brilliant.

S: Yeah, that is brilliant. It's brilliant to have a vehicle for discussing a complex job like teaching. It's also about acknowledging that it's not easy..... the job so we need to share, talk about it so yeah a definitely worth while thing to do.

L: That's great. Thanks

S: That's the lot?

L: It is! Thanks for your time, I really appreciate it.

